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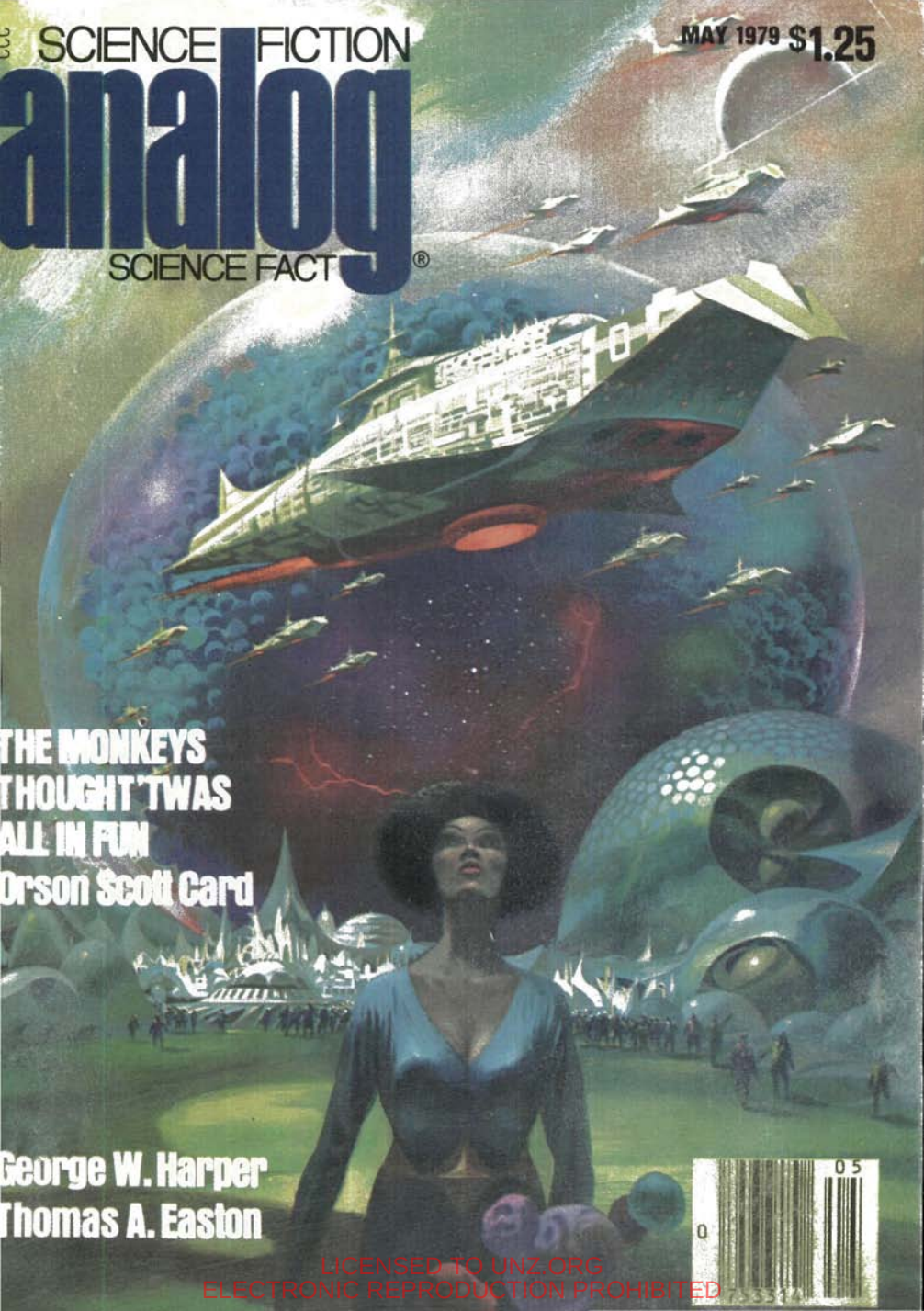

THE MONKEYS THOUGHT 'TWAS ALL IN FUN
Orson Scott Card

George W. Harper
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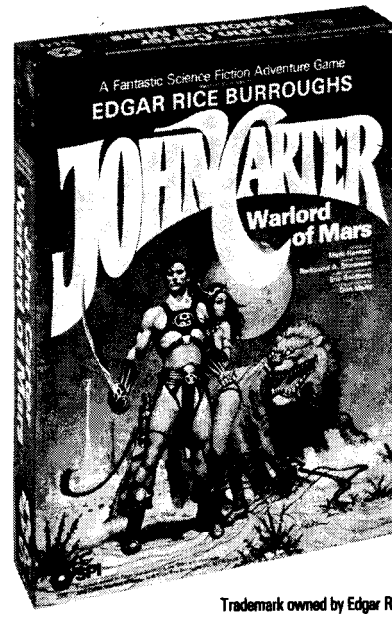

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servant's pay

Could I interest you in a job?

Naturally you'd need to know something about the job before deciding, so let me tell you a few of its features. It offers a good salary—in the high fifties per year—and an excellent package of fringe benefits. It has a good deal of security. Not, to be sure, as much as a king or a college professor, who can be tenured for life, but the holder of this job will be hired for either two or six years, with the possibility of renewal at the end of that period. Of course, there is the possibility that you won't be renewed, but at least until renewal times comes you can be quite confident that your salary will not decrease—regardless of how well you're doing or not doing your job. It may even increase—either in automatic response to a rise in the cost of living, or because you and your fellow jobholders decide you would like more and therefore help yourselves to it. This last may sound a bit shady, but rest easy: it's all perfectly legal.

One slight possible drawback is that you will occasionally have to put up with being called a "servant"—but you wouldn't go into this just for status, anyway, would you? Actually, under the right circumstances, the word *servant* can acquire a certain noble glow, and you may in time even come to refer to yourself that way—and not without a certain note of pride.

The job, in case you haven't guessed yet, is that of a member of the U.S. Congress. Senators and Congressmen are often referred to as "public servants," but they are elected for terms of six and two years, respectively, and they do get, in addition to many fringes, salaries which are currently $57,500 but are subject to cost-of-living adjustments (voted by Congress itself) and other increases (also voted by Congress). (In fairness, I should mention that a couple of bills were

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recently introduced attempting to repeal the automatic cost-of-living adjustments; but, at the time of this writing, I was unable to find a report of their final disposition.)

As one of the employers of these servants who has personally never received either a salary that large or the privilege of giving myself raises, I find a number of features of this arrangement at least mildly interesting. I might even respectfully venture to suggest one or two possible modifications of the system.

Consider, to begin, the salary itself: $57,500 per year. Is it remotely conceivable that that's a bit higher than really necessary? Perhaps not. I've been told, for instance, that it needs to be that high to attract the best men (and women) into the jobs.

Hm-m-m. Do you really believe it's doing that?

I've also read, in interviews with Congressmen and Senators, that their salaries have to be that high—and increased as often and as much as they have been—because the legislators need that much to live in Washington. I can easily understand that they'd need that much to live in the style to which they like to be accustomed—but to live at all, or even in moderate comfort? Need I point out that many, many people in Washington must and do live on far less? It just might be character-building for our legislators to have some firsthand knowledge of how it feels to do so. In any case, I respectfully submit that a lawmaker who admits he just can't manage on less than $57,500 a year should be judged *a priori* incompetent to be allowed to meddle in the country's finances.

I propose for consideration that the wages of Congress (and other legislators) should be made high enough that a competent, conscientious, careful person can live fairly well, but not lavishly, on them—and low enough that he *has* to be competent, conscientious, and careful. They should be too small to be a major attraction of the job—which implies that the job must provide other attractions that will appeal to competent and conscientious candidates. (At this point you might say, "Many members of Congress are already rich enough that the pay isn't a major consideration anyway." True enough—but if you're going to use that argument, what happens to the one about making the salary big enough to attract the best people and let them live in Washington? Be consistent!) It may be asking a lot to want somebody to go into a moderately paid job for largely altruistic motives—but some people (e.g., some teachers) do just that. Sure, it takes rare people—but that's the kind we want, isn't it?

Even if I could sell the idea that legislative salaries should be reduced, there's a big practical obstacle to getting it implemented: the fact that Congress determines its own salary, and very few people, given the power, would voluntarily *reduce* their own income. It's a rare privilege; I can think of few if any other professions

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which share it. Other legislators do, of course; the Ohio and Illinois legislatures, to give two examples from an abundant supply, recently gave themselves pay raises of 29 and 40 percent, respectively. But that's not a different profession; it's just another example of this one, and much of what I say about Congress applies just as well to state and local legislatures. How many people in other occupations can, singly or collectively, give themselves raises? Top-echelon corporate executives can, at least in some corporations—but those raises must come from the proceeds of an operation which is frankly intended to make money, and management's raises are at least roughly limited by the extent to which it does. Congress, supposedly, is not in business to make money. A self-employed plumber, basketmaker, or lawyer can raise his fees—but that only constitutes a raise to extent that his customers are willing to go along with the increased charges. They may not always have much choice—if they really need or badly want a particular service or product, and nobody else is offering it cheaper, they'll pay what they must. In principle, though, the customer in most fields has the option of refusing to pay excessive prices, or to pay for shoddy work, and either doing the job himself or taking his business elsewhere.

Legislators' customers have no such options; Congress has "captive customers." True, a dissatisfied citizen can leave the country (if he can afford to) but that hardly seems an acceptable recourse. It's unduly drastic, and it's based on hopelessly misordered priorities. The citizens, not Congress, are what the country and its government are here for; Congress needs to accommodate itself to the needs of the people, not the other way around. Congress is a public servant, remember?

A *tenured* servant—and one which can dip into its employer's pockets pretty much at will and take what it claims to need. As a member of that employer—the public—I find it a wee bit odd that my servants can help themselves to raises bigger than my salary (which has literally happened).

There is, you may point out, one more realistic recourse a dissatisfied customer can have: throw the bums out. That is, at the end of the two or six-year term, an unsatisfactory Representative or Senator can be voted out of office. This option does provide the possibility of replacing individual nonproductive or counterproductive employees, but the employers have learned to be a bit cynical about the prospects for finding truly satisfactory replacements. About the only thing they can be sure of is that they're not going to get anybody who will do the same job, or a better one, for less money.

(Which raises an interesting question for some writer out there to consider. Could a government be made to work with its members chosen on a competitive-bidding basis? For example, suppose candidates run for office, as they do now—but instead

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of running for a job at a fixed salary paid from federal funds, each candidate states the salary he will accept as part of his platform. The figure he "bid" is what the winner is paid—not by the federal government, but by his own constituents in the state or district that elected him. Sure, there are problems—but don't dismiss it out of hand. Try to figure out how it *could* work, and see what flaws remain after you've done your best. The present system isn't free of them, either, you know.

And this proposal, I gently suggest, should encourage the voters to pay a little closer attention to what they're paying for representation and whether they're getting their money's worth. It just might even encourage the congressmen themselves to give a little thought to how to provide maximum service for minimum cost.)

Assuming that a way could be found to wrest some control of legislative pay away from the legislators and give it to those they serve, I have one final suggestion about how that pay should be determined. While any wages need to be adjusted periodically in response to changing times, an automatic cost-of-living increase would seem to be exactly the wrong way to go about it in the special case of Congress. In these days of galloping inflation, such increases seem almost necessary for many people. (Maybe . . . though I don't really understand economics well enough to be sure how much they cure and how much they contribute to the problem. I'm not sure anybody else does, either, including the economists who claim to.)

But for Congress and other legislators, pay raises even roughly proportional to the inflation rate seem most inappropriate. Government is supposed to establish policies to help keep the economy healthy; everybody seems to agree that inflation is unhealthy and is in fact one of the main economic diseases that government should be treating. A cost-of-living increase for legislators actually rewards people who should be helping to control inflation for failure to do so. The reward is in direct proportion to the extent of the failure, yet: the farther they fall short of solving the problem, the more extra pay they get!

The irony in this is quaint, but only briefly amusing. I suppose this: an inflation-controlled, *negative*, cost-of-living adjustment for legislators and other such officials. For example, if the inflation rate this year is 9 percent next year's legislative salaries are *reduced* 9 percent. That might—at least for those legislators for whom salary is significant—provide a real incentive to find something that *works* on inflation.

Of course, not being really as nasty a man as I may seem at this point, let me add in closing that I believe in carrots as well as sticks. If the cost of living goes *down*, legislators' salaries would go *up* by the same percentage.

In that case, there'd be at least circumstantial evidence that they'd earned it. ■

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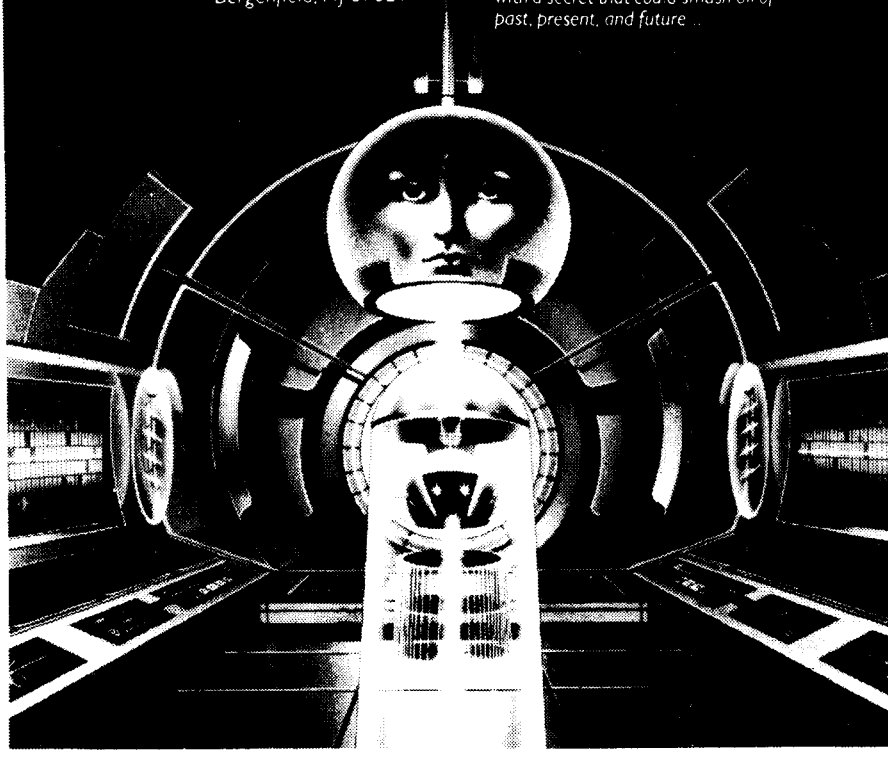

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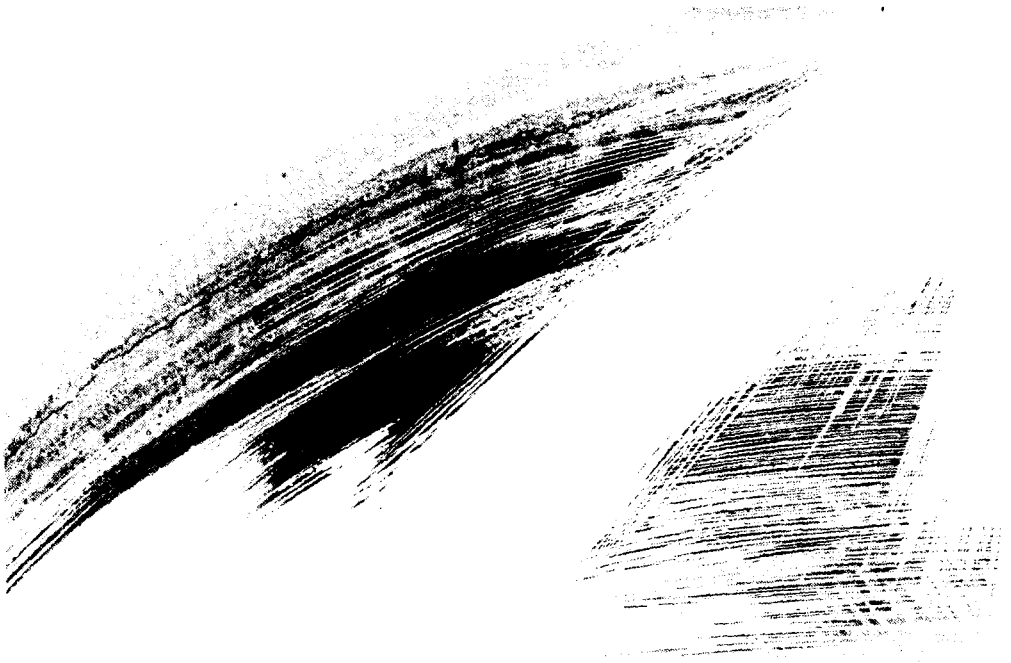

The most attractive morsels oft contain hooks . . .

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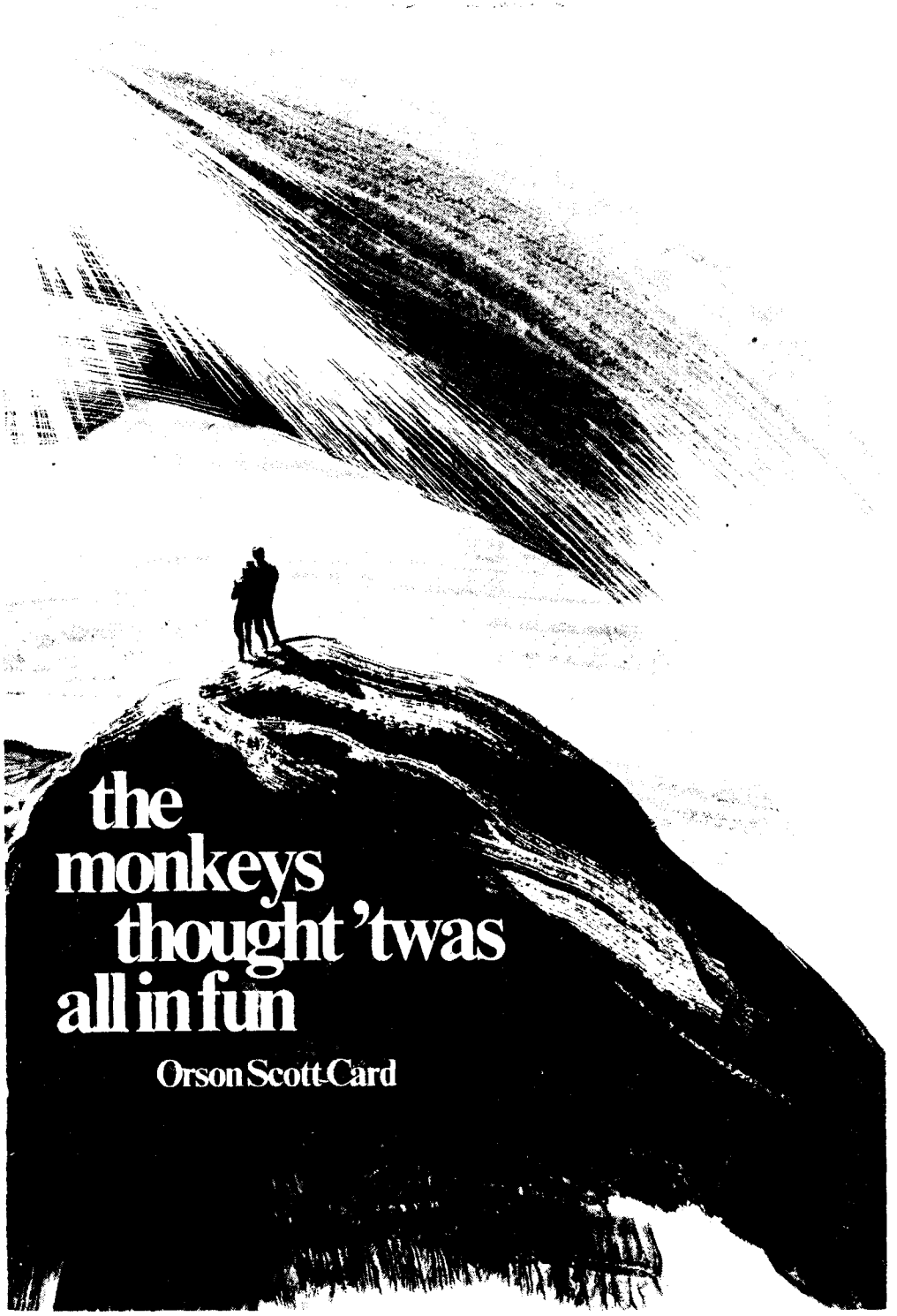

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Agnes 1

"Take her," Agnes's father said, his dry eyes pleading. Agnes's mother stood just behind him, wringing the towel she held in her hand.

"I can't," Brian Howarth said, embarrassed that he had to say that, ashamed that he actually *could* say it. The death of the nation of Biafra was a matter of days now, not weeks, and he and his wife were some of the last to go. Brian had come to love the Ibo people, and Agnes's father and mother had long since ceased to be servants—they were friends. Agnes herself, a bright five-year-old, had been a delight, learning English even before she learned her native tongue, constantly playing hide-and-seek in the house. A bright child, a hopeful child, and from all that Brian had heard (and he believed it, even though he was a correspondent and knew the exaggerations that wartime news always had to endure), from all he had heard the Nigerian Army would not stop to ask anyone, "Is this child bright? Is this child beautiful? Does this child have a sense of humor as keen as any adult's?" Instead she would be gutted with a bayonet as quickly as her parents, because she was an Ibo, and the Ibos had done what the Japanese did a half-century before: they had become westernized before any of their neighbors, and profited from it. The Japanese had been on an island, and they had survived. The Ibos were not on an island, and Biafra was destroyed by Nigerian numbers and British and Russian weapons and a blockade that no nation on Earth made any effort to relieve, not on a scale that could save anyone.

"I can't," Brian Howarth said again, and then he heard his wife behind him (her name was also Agnes, for the little girl's parents had named their first and only child after her) whisper, "By God you can or I'm not going."

"Please," Agnes's father said, his eyes still dry, his voice still level. He was begging, but his body said I am still proud and will not weep and kneel and subjugate myself to you. Equal to equal, his body said, I ask you to take my treasure, for I will die and cannot keep it anyway.

"How can I?" Brian asked helplessly, knowing that the space on the airplane was limited and the correspondents were forbidden to take any Biafrans with them.

"We can," his wife whispered again, and so Brian reached out his arms and took Agnes and held her. Agnes's father nodded. "Thank you, Brian," he said, and Brian was the one who wept and said, "I'm sorry, if any people in the world deserve to be free—"

But Agnes's parents were already gone, heading for the forest before the Nigerian Army could get into town.

Brian and his wife took little Agnes to the stretch of abandoned highway that served as the last airport in free Biafra and took off in an airplane crammed with correspondents and luggage and more than one Biafran child sitting in the darkest corners of

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what was never meant to be a passenger plane. Agnes's eyes were wide all through the flight. She did not cry. She had never cried much as an infant. She just held tightly to Brian Howarth's hand.

When the airplane landed in the Azores, where they would change to a flight to America, Agnes finally asked, "What about my parents?"

"They can't come," Brian said.

"Why not?"

"There wasn't room."

And Agnes looked at the many places where another couple of human beings could sit or stand or lie, and she knew that there were other, far worse reasons why her parents couldn't be with her.

"You'll be living with us in America now," Mrs. Howarth said.

"I want to live in Biafra," Agnes said. Her voice was so loud that it could be heard throughout the airplane.

"Don't we all," said a woman farther in the front. "Don't we all."

The rest of the flight Agnes passed in silence, unimpressed by the clouds and the ocean below her. They landed in New York, changed planes again, and at last reached Chicago. Home.

"Home?" Agnes echoed, looking at the two-story brick house that loomed out of the trees and lawn and seemed to hang brightly over the street. "This isn't home."

Brian couldn't argue with her. But Agnes was a Biafran, and there would never be home for her again.

Years later, Agnes would remember little about her escape from Africa. She would remember being hungry, and how Brian gave her two oranges when they landed at the Azores. She would remember the sound of antiaircraft fire, and the rocking of the plane when one shell exploded dangerously near. Most of all, however, she remembered the white man sitting across from her in the dark airplane. He kept looking at her, then at Brian and Agnes Howarth. Brian and his wife were black, but their blackness had been diluted by frequent infusions of white blood in past generations; little Agnes was much, much darker, and the white man finally said, "Little girl. You Biafran?"

"Yes," Agnes said softly.

The white man looked angrily at Brian. "That's against the regulations."

Brian calmly answered, "The world will not shift on its axis because a regulation was broken."

"You shouldn't have brought her," the white man insisted, as if she were breathing up his air, taking up his space.

Brian didn't answer. Mrs. Howarth did. "You're only angry," she said, "because your Biafran friends asked you to take their children, and you refused."

The man looked angry, then hurt, then ashamed. "I couldn't. They had three children. How could I claim they were mine? I couldn't do it!"

"There are white people on this airplane with Biafran children," Mrs. Howarth said to him.

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Angry, the white man stood, "I followed the regulations! I did the right thing!"

"So relax," Brian said, quietly but with command in his voice. "Sit down. Shut up. Console yourself that you obeyed the regulations. And think of those children with a bayonet slicing—"

"Shhh," Mrs. Howarth said. The white man sat back down. The argument was over. But Agnes always remembered that afterward, the man had wept bitterly, for what seemed hours, sobbing almost silently, his back heaving. "I couldn't do a thing," she heard him say. "A whole nation dying, and I couldn't do a thing."

Agnes remembered those words. "I couldn't do a thing," she sometimes said to herself. At first she believed it, and wept for her parents in the silence in her home on the outskirts of Chicago. But gradually, as she forced her way past the barriers society placed before both her sex and her race and her foreign background, she learned to say something different:

"I can do something."

She went back to Nigeria with her adopted parents, the Howarths, ten years later. Her passport showed her to be an American citizen. They returned to her city and asked in her real family where her parents were.

"Dead," she was told, not unkindly. No relative closer than a second cousin was left alive.

"I was too young," she said to her parents. "I couldn't do a thing."

"Me too," Brian said. "We were all too young to do anything."

"But I'll do something someday," Agnes said. "I'll make up for this."

Brian thought she meant revenge, and spent many hours trying to dissuade her. But Agnes did not mean revenge.

Hector 1

Hector felt large when he saw the light, large and full and light and vigorous, and the light was the right color and the right brightness and so Hector gathered himselves and followed the light and drank it deep.

And because Hector loved to dance, he found the right place and began to bow, and spin, and arch, and crest, and be a thing of great dark beauty.

"Why are we dancing?" the Hectors asked themself. And Hector told himselves, "Because we are happy."

Agnes 2

Agnes was already known as one of the two or three best skipship pilots when the Trojan Object was discovered. She had made two Mars trips and dozens of journeys to the moon, many of them solo, just her and the computer, others of them with valuable cargos—famous people, vital medicines, important secret information—the kind of thing valuable enough to make it worth the price of sending a skipship from the ground out into space.

Agnes was a pilot for IBM-ITT, the largest of the companies that had invested in space; and it was partly

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because IBM-ITT promised that she would be pilot on the expedition, that the corporation won the lucrative government contract to investigate the Trojan Object.

"We got the contract," Sherman Riggs told her, and she had been so involved in updating the equipment on her skipship that she didn't know what he meant.

"The *contract*," he said. "*The* contract. To go to the Trojan Object. And you're the pilot."

It was not Agnes's habit to show emotion, whether negative or positive. The Trojan Object was the most important thing in space right now, a large, completely light-absorbent object in the Earth's leading trojan point. One day it had not been there. The next day it had, blotting out the stars beyond it and causing more of a stir in the space-watching world than a new comet or a new planet. After all, new objects should not suddenly appear a third of the way around Earth's orbit. And now it would be Agnes who would pilot the craft that would first view the Trojan Object up close.

"Danny," she said, naming her Leaner, the lover/engineer who always teamed with her on two-person assignments. On a long trip like this, no pilot could stand to be without his or her Leaner.

"Of course," Sherman answered. "And two more. Roger and Rosalind Thorne. Doctor and astronomer."

"I know them."

"Good or bad?"

"Good enough. Good. If we can't get Sly and Frieda."

Sherman rolled his eyes. "Sly and Frieda are GM-Texaco, and there isn't a chance in hell—"

"I hate it when you roll your eyes, Sherman. It makes me think you're having a fit. I know Sly and Frieda are hopeless, but I had to ask, didn't I?"

"Roj and Roz."

"Fine."

"How much do you know about the Trojan Object?"

"More than you do and less than I'll need to."

Sherman tapped his pencil on his desk. "All right, I'll send you straight to the experts."

And a week later, Agnes and Danny and Roj and Roz were ensconced in Agnes's skipship, sweeping down the runway at Clovis, New Mexico. The acceleration was frightful, particularly after they were vertical, but it was not long before they were in a high orbit, and not much longer than that before they were free of the Earth's gravity, making the three-month trip to Earth's leading trojan point, where something waited for them.

Hector 2

Hector said to himselves, "I'm thirsty, I'm thirsty, I'm thirsty," and the Hectors gave themself plenty to drink, and when Hector was satisfied, for the moment, he sang a soundless song that all the Hectors heard, and they, too, sang:

Hector swims in an empty sea
With Hectors all around.
Hector whistles merrily

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But never makes a sound.
Hector swallows all the light
So he's snug out in the cold.
Hector will be born tonight
Although he's very old.
Hector sweeps up all the dust
And puts it in a pile:
Waybread for his wanderlust,
More Hectors in awhile.

And the Hectors laughed and also sang and also danced because they had come together after a long journey and they were warm and they were snug and they lay together to listen to themself tell himselves stories.

"I will tell," Hector said to himselves, "the story of the Masses, and the story of the Masters, and the story of the Makers."

And the Hectors cuddled together to listen.

Agnes 3

Agnes and Danny made love the day before they reached the Trojan Object, because that made it easier for both of them to work. Roj and Roz did not, because that made it easier for them to stay alert. For a week it had been clear that the Trojan Object was far more than anyone on Earth had suspected, and far less.

"Diameter about 1400 kilometers on the average," Roz reported as soon as she had good enough data to be sure. "But gravity is about as much as a giant asteroid. Our shaddles are strong enough to get us off."

Danny spoke the obvious conclusion first. "There's nothing that could be as solid as that, as large as that, and as light as that. Artificial. Has to be."

"Fourteen hundred kilometers in diameter?"

Danny shrugged. Everybody could have shrugged. That's what they were here for. Nothing natural could have suddenly appeared in Earth's leading trojan point, either—obviously it was artificial. But was it dangerous?

They circled the Trojan Object dozens of times, letting the computer scan with better eyes than theirs for any sign of an aperture. There was none.

"Better set down," Roz said, and Agnes brought her skipship close to the surface. It occurred to her as she did so that she and Danny and the others changed personality completely when they worked. Fun-loving, filthy-minded, game-playing friends, until work was needed. Then the fun was over, and they became a pilot and an engineer and a doctor and a physicist, functioning smoothly, as if the computer's integrated circuits had overcome the flesh barrier and inhabited all of them.

Agnes maneuvered her craft within three meters of the surface. "No closer," she said. Danny agreed, and when they were all suited up, he opened the hatch and shaddled down to the surface. "Careful, Leaner," Agnes reminded him. "Escape velocity and everything."

"Can't see a damn thing down here," he answered in a perfect non sequitur. "This surface material sucks up *all* light. Even from my headlamp. Hard and smooth as steel, though. I have to keep shining my light on my

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hands to see where they are." Silence for a few moments. "Can't tell if I'm scratching the thing or not. Am I getting a sample?"

"Computer says no," Roj answered. As the doctor, he had nothing better to do at the moment than monitor the computer.

"I'm not making any impact on the surface at all. I want to find out how hard this thing is."

"Torch?" Agnes asked.

"Yeah."

Roz protested. "Don't do anything to make them mad?"

"Who?" Danny asked.

"Them. The people who made this."

Danny chuckled. "If there's anybody in there, they either know we're out here or they're sure enough we can't get in that they don't care. Either way, I've got to do something to attract their attention."

The torch flared brightly, but nothing was reflected from the surface of the Trojan Object, and only the gas dissipated with the torch made it visible.

"No result. Didn't even raise the surface temperature," Danny said.

They tried laser. They tried explosives. They tried a diamond tip on a drill for repair work. Nothing had any effect on the surface at all.

"I want to come out," Agnes said.

"Forget it," Danny answered. "I suggest we go to the pole, north or south. Maybe something's different there."

"I'm coming out," Agnes said.

Danny was angry. "What the hell do you think you can accomplish that I haven't done!"

Agnes frankly admitted that there wasn't anything she could possibly do. While she was admitting it she clambered out of the skipship and launched herself toward the surface.

It was a damn fool thing to do, as Danny informed her loudly over the radio, just as he turned to face Agnes and flashed his light directly in her eyes.

She realized to her alarm that he was directly below her—she couldn't turn around and shaddle down. She slipped to the right, instead, and then tried to turn around, but because of her panic at the thought of colliding with Danny (always dangerous in space) and the delay as she maneuvered to avoid him, she struck the planet surface going a good deal faster than should have been comfortable.

But as she touched the surface, it yielded. Not with the springiness of rubber, which would have forced her hand back out, but with the thick resistance of almost-hard cement, so that she found her hand completely immersed in the surface of the planet. She shone her headlamp on it—the smooth surface of the planet was unbroken, not even dented, except that her hand was in it up to the wrist.

"Danny," she said, not sure whether to be excited or afraid.

He didn't hear her at first because he was too busy shouting, "Agnes, are you OK," into the radio to notice that she was already answering. But at last

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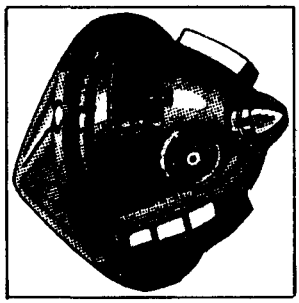

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he calmed down, found her with his headlamp, and came over to her, shaddling gently to stay tight to the surface of the Trojan Object.

"My hand," she said, and he followed her shoulder and her arm until he found her hand and said, "Agnes! Can you get it out?"

"I didn't want to try until you saw this. What does it mean?"

"It means that if it was wet cement it's hard by now and we'll never get you off!"

"Don't be an ass," Agnes said. "Test around it. See if it's different."

Except for the torch, Danny made all the same tests. Right up to the edge of Agnes's suit the Trojan Object's surface was absolutely impenetrable, completely absorbent of energy, nonmagnetic—in other words, untestable. But there was no arguing the fact that Agnes's hand was buried in it.

"Take a picture," Agnes said.

"What will that show? It'll look like your wrist with the hand cut off." But Danny went ahead and laid some of his tools on the surface to give some hint in the photograph of where the surface actually was. Then he took a dozen or more photos. "Why am I taking these pictures?" he asked.

"In case we go back and people don't believe I could stick my hand into something harder than steel," Agnes answered.

"I could have told them that."

"You're my Leaner."

Leaners were very good for some things, but you'd never want to be the prosecutor whose case against the defendant rested entirely on the Leaner's testimony. Leaners were loyal first, honest second. Had to be.

"So we've got the pictures."

"So now I get out."

"Can you?" Danny asked. He had only postponed his concern for her; now it was back in full force.

"My knees and my other hand were both sunk in just as deep. The reason this one is still in is because I clenched my fist and I'm still holding on."

"Holding on to what?"

"To whatever this damn thing is made of. My other hand and my knees floated to the surface after a few seconds."

"Floated!"

"That's what it felt like. I'm letting go now." And as Agnes unclenched her fist her hand slowly rose to the surface and was gently ejected. There wasn't a ripple on the surface material, however. Where her hand was, it behaved like a liquid. Where her hand wasn't, it was as solid as ever.

"What is this made of?"

"Silly putty," Agnes said.

"Unfunny," Danny answered.

"I'm serious. Remember how silly putty was flexible, but if you formed it into a ball and threw it on the ground, it broke like clay?"

"Mine never worked like that."

"But this stuff does, in reverse. When something sharp hits it, or something hot, or something too slow or too weak, it sits there. But when I ran into it going at shaddle speed, I sank in it for a few inches."

"In other words," Roj said from the

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skipship, "you've found the door."

They were back in the skipship inside ten minutes, and after only a few more minutes of checking everything to make sure it was in good condition, Agnes pulled the skipship a few dozen meters away from the surface of the Trojan Object. "Everybody ready?" Agnes asked.

"Are we doing what I think we're doing?" Roz asked.

"Yep," Danny answered. "We shore is."

"Then we're idiots," Roz said, her voice sounding nervous. No one argued with her.

Agnes fired the vernier rockets on the outboard side and they plunged toward the Trojan Object. Not terribly fast, by the standard of speed they were used to. But to those aboard, who knew that they were heading directly into a surface so hard a diamond drill and a laser had no effect at all, it was disconcertingly fast.

"What if you're wrong?" Roz asked, pretending she was joking.

No one could answer before they hit. But in the moment where there should have come a violent crunch and a rush of atmosphere escaping from the ship, the skipship merely slowed sickeningly and kept moving inward. The black flowed quickly past the viewports, and they were buried in the surface of the Trojan object.

"Are we still moving?" Roj asked, his voice trembling.

"You've got the computer," Agnes answered, flattering herself that she, at least, did not sound scared. She was wrong, but no one told her.

"Yeah," Roj finally said. "We're still moving. Computer says so."

And then they sat in silence for an interminable minute. Agnes was just about to say, "Maybe this isn't such a good idea. I've changed my mind," when the blackness turned to a reflective brown through the window, and then, just when they'd had time to notice it, the brown turned into a bright, transparent blue—"Water!" Danny said in surprise—and then the water broke and they bobbed on the surface of a lake, the sun dazzlingly bright on the surface.

Hector 3

"First I will tell you the story of the Masses," Hector said to himselves. Actually, the telling of the stories was not necessary. As Hector drank, all that he had been through, all that he had known through the years of his life was being transferred subliminally to himselves. But there was the matter of focus. The matter of meaning. Hector had no imagination at all. But he did have understanding, and that understanding had to be passed to himselves, or in ages to come the Hectors would curse themself for having left himselves crippled.

This is the story, therefore, that he told, because it focussed and it meant:

Cyril [said Hector] wanted to be a carpenter. He wanted to cut living wood and dry it and cure it and shape it into objects of beauty and utility. He thought he had an eye for it. As a

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child he had experimented with it. But when he applied at the office of Assignments, he was told no.

"Why not?" he asked, astonished that the office of Assignments could make such an obvious mistake.

"Because," said the clerk, who was unflaggingly nice (she had tested nice and therefore held her job), "your aptitude and preference tests show that not only do you not have any aptitude along those lines at all, but also you do not even want to be a carpenter."

"I want to be a carpenter," Cyril insisted, because he was young enough not to know that one does not insist.

"You want to be a carpenter because you have a false impression of what carpentry is. In actual fact, your preference tests show that you would absolutely hate life as a carpenter. Therefore you cannot be a carpenter."

And something in her manner told Cyril that there was no point in arguing any further. Besides, he was not so young to know that resistance was futile—and continued resistance was fatal.

So Cyril was placed where his tests showed he had the most aptitude: He was trained as a miner. Fortunately, he was not untalented or utterly unbright, so he was trained as a lead miner, the one who follows the vein and finds it when it jogs or turns or jumps. It was a demanding job. Cyril hated it. But he learned to do it because his preference tests showed that he really wanted and was suited to this line of work.

Cyril wanted to marry a girl named Lika, and she wanted to marry him. "I'm sorry," said the clerk at the office of Assignments, "you are genetically, temperamentally, and socially unsuited for each other. You would be miserable. Therefore we cannot permit you to marry."

They didn't marry, and Lika married someone else, and Cyril asked if it was all right if he remained unmarried. "If you wish. That's one of your options for optimum happiness, according to the tests," the clerk informed him.

Cyril wanted to live in a certain area, but he was forbidden; food was served for him that he didn't like; he had to go dancing with friends he didn't like, doing dances to music he loathed, singing songs whose words were silly to him. Surely, surely there's been a mistake, he said, pleading with the clerk.

The clerk fixed a cold stare on him (he tried in vain to scrub the stare off, but still it hung to him like slime in his dreams) and said, "My dear Cyril, you have now protested as often as a citizen may protest and remain alive."

In just such a case many another member of the masses might have rebelled, joining the secret underground organizations that sprang up from time to time and were crushed at regular intervals by the state. In just such a case many another member of the masses, knowing he or she was consigned to a lifetime of undeserved misery, would kill himself or herself

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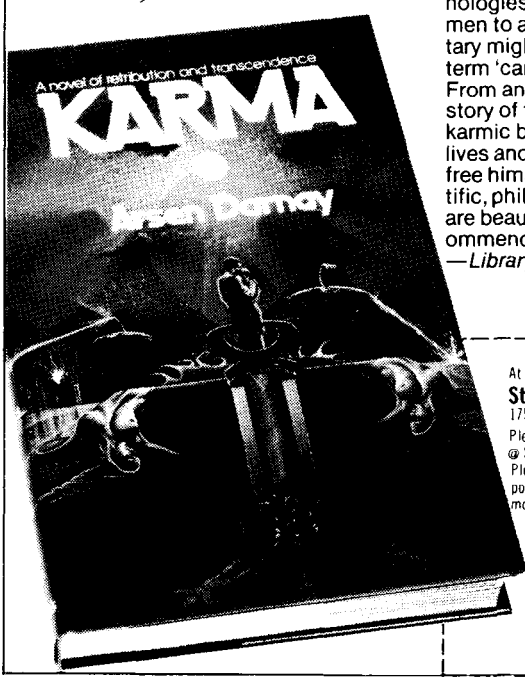

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and thereby eliminate the misery.

However, Cyril belonged to the largest group within the masses, and so he chose neither route. Instead he went to the town he was assigned to, worked in the coal mine where he was assigned, remained lonely as he pined for Lika, and danced idiotic dances to idiotic music with his idiotic friends.

Years passed, and Cyril began to be well-known among coal miners. He handled his rockcutter as if it were a delicate tool, and with it he left beautiful shapes in the rock behind, so that any miner could tell when he walked down a tunnel cut by Cyril, for it would be beautiful, and as he walked the miner would feel exalted and proud and, oddly, loved. And Cyril also had a knack for anticipating the coal, following where it led no matter how narrow the seam, how twisting its path, how interrupted its progress.

"Cyril knows the coal like a woman, every twist and turn of her, as if he'd had her a thousand times and knew just when she'd come," a miner said of Cyril once, and because the statement was apt and true (and because there are poets' hearts beating even at the bottom of a mine) the statement spread through the mines and the miners began referring to their black stone as "Mrs. Cyril." Cyril heard of it, and smiled, because in *his* heart coal was not a wife, only an unloved mistress used for the scant pleasure she gave and then cast away. Hatred mistaken for love, as usual.

Cyril was nearly sixty years old when a clerk from the office of Assignments came to the mines. "Cyril the coalminer," the clerk said, and so they brought Cyril from the mines, and the clerk met him with a huge, unbelievable smile. "Cyril, you are a great man!" cried the clerk.

Cyril smiled wanly, not knowing what all this was leading up to.

"Cyril, my friend," said the clerk, "you are a notable miner. Without seeking fame at all, your name is known to miners all over the world. You are the perfect model of what a man ought to be—happy in your assignment, hardworking, content. So the office of Assignments has announced that you are the Model Worker of the Year."

Everyone knew about Model Worker of the Year. That was a person who had his picture in all the papers, and was in the movies and on television and who was held up as the greatest person in all the world in that year. It was an honor to be envied.

But Cyril said, "No."

"No?" asked the clerk.

"No. I don't want to be the Model Worker of the Year."

"But—but. But why not?"

"Because I'm not happy. I was put into this assignment by mistake many years ago. I shouldn't be a coal miner. I should be a carpenter, married to Lika, living in another town, dancing to other music with other friends."

The clerk looked at him in horror. "How can you say that!" he cried. "I've announced that you are Model Worker of the Year! You will either be Model Worker of the Year or you

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will be put to death!"

Put to death? Forty years ago that threat had made Cyril comply, but now a stubborn streak erupted from him, like a seam of coal long hidden but under such pressure that when the stone around it gave way, it actually burst from the rock walls. "I'm near sixty," Cyril said, "and I've hated all my life to now. Kill me if you like, but I won't go on television or the movies saying how happy I've been because I haven't."

And so they took Cyril and locked him in prison and sentenced him to death because while he might suffer all kinds of abuse, he refused to lie to his friends.

That is the story of the Masses.

And when Hector was finished, the Hectors sighed and wept (without tears) and said, "Now we understand. Now we know the meaning."

"This isn't," Hector said, "the whole meaning."

And when he had said that, one of the Hectors (which was remarkable, for the Hectors had never before spoken alone) said to himselves and themself, "Oh, oh, they have penetrated me!"

"Trapped!" Hector cried to himselves. "All these years of freedom, and they have found me at last!" But then another thought came to him, one that he had never thought before but that had lain dormant in him, waiting for this moment to emerge, and he said, "Just cooperate. They won't hurt you if you just cooperate."

"But it already hurts!" cried the Hector who had spoken alone.

"It will heal. Just remember, no matter what you do, the masters will have their way with you. And if you struggle, it only goes worse with you."

"The masters," said all the Hectors to themself. "Tell us a story of the masters, so we can understand why they do what they do."

"I will," said Hector to himselves.

Agnes 4

Agnes and Danny stood on a mountaintop, or what had seemed to be a mountaintop from the skipship. They had reached it after only a few hours' walk, much of it sped by shaddling, and learned that what seemed to be a high mountain was only a few hundred meters high, maybe even half a kilometer. It was rugged enough, though, and the climb, even shaddled, had not been easy.

"Artificial," Danny said, touching the wall with his hand. The wall ran from the top of the mountain up to the ceiling, where instead of a sun the whole ceiling glowed with light and warmth, as thorough as sunlight, yet diffused so that they could look at it for a few seconds without being blinded.

"I thought we concluded this place was artificial from the beginning," Agnes said.

"But what's it *for*," Danny answered, letting his frustration at two days of exploration come to the surface. "Bare dirt, rich enough but with

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not a damn thing growing. Clean, drinkable water. Rain twice a day for twenty minutes, a gentle sprinkle that wets everything but creates almost no runoff. Sunlight constantly. A perfect environment. But for what! What lives here?"

"Us, right now," Agnes said.

"I think we should try to leave."

"No," Agnes said firmly. "No. When we leave here, if we can, we'll leave with the computer and our heads full of every bit of information we can get from this place. From this thing."

Danny knew he couldn't argue. She was right, and she was pilot, and the combination was irresistible even if he hadn't loved her desperately. (More than she loves me, he sometimes admitted to himself.) He loved her desperately, however, and while this did not mean that he utterly lost his own will, it did mean that he would go along with her, for a while at least, in almost anything. Even if she was a damned fool sometimes.

"You're a damned fool sometimes," he said.

"I love you too," she answered, and then she ran her hand along the wall above the mountain, and then pushed on it, and then pushed harder, and her hand sank into the wall a little. She looked at Danny and said, "Come on, Leaner," and they let their shaddles push them through the wall and they emerged on the other side and found themselves—

Standing on a mountain.

Looking out over a large bowl of a valley, just like the one they had left, with a lake in the middle, just like the one where their skipship floated.

In this lake, however, there was no skipship, and Agnes looked at Danny and smiled, and Danny smiled back. "I'm beginning to get this, a little," Agnes said. "Imagine cell after cell like this, kilometers long and hundreds of meters high—"

"But this is just the outer part of this thing," Agnes answered, and in unison they turned back to the wall, passed through again (and this time there was the skipship in the middle of the lake), and then shaddled up the wall to the ceiling.

As they approached the ceiling, the area directly above them dimmed, until when they finally reached it, it was as cool and undazzling as the wall. The rest of the ceiling still glowed, of course. They let their shaddles push them upward into the ceiling; it gave way; they rose until they reached the surface.

Another cell, just like the one below. A lake in the middle, rich lifeless dirt all over, mountains all around, the sky on fire with sunlight. Danny and Agnes laughed and laughed. It was only a tiny part of the mystery, but it was solved.

They stopped laughing, however, when they tried to go back down the way they came. They tried to shaddle into the earth, but the soil acted like any normal dirt on Earth. They could not get through it as they had got through the walls and the ceiling.

For a while they were afraid, and when their bodies and their watches

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told them it was time to sleep, they went down by the lake and slept.

When they woke up, they were still afraid, and it was raining. They had already determined that it rained every thirteen and a half hours, approximately—they had not slept particularly long. But because they were afraid, they took off their suits despite the rain and made love in the dirt on the shore of the lake. They felt better afterward, much better, and they laughed and ran into the lake and swam and splashed each other.

Agnes swam underwater for a moment, attacking Danny from below, pulling him down. It was a game they had played in pools and in the ocean on Earth, and now Danny was supposed to surface for air and then dive to the bottom and hold his breath there until Agnes found him.

When he reached the bottom of the lake (and it wasn't deep) he touched it, and his hand sank up to the wrist before it struck something solid. But even the solid part was yielding, and as Danny kicked harder his hand sank deeper and he knew the way out.

Agnes found him. They went to the surface. And he told her what he had found. They swam to shore, put their suits back on, and shaddled down into the water. The lake floor opened, engulfed them, and then floated them out the bottom—into the sky directly over the skipship, where it still rested on the surface of the lake.

"This place is explorable," Agnes told Roj and Roz, "and it's simple. It's like a huge balloon, with other balloons inside and more and more of them, layer after layer. It's designed for somebody to live here, so when you're standing on the soil you don't sink through. To get down, you have to go through the lake."

"But who's it for?" Roj asked, and it was a good question for which there was no answer.

"Maybe we'll find someone," Agnes said. "We've only scratched the surface. We're going in."

The skipship lifted from the lake not long after, and rose through the ceiling into the lake above. Again and again, always rising, the computer keeping count. Every cell was the same, nothing changed at all, through 498 layers or ceiling/floor, until at last they reached a ceiling, apparently no different from the others, which would not give way.

"End of the road?" Danny asked.

Always thorough, Roz insisted that they try every part of the ceiling, and they spent many hours doing it, until they had convinced themselves that this ceiling was the end of their upward (or inward) travels.

"The centrifugal gravity effect is a lot weaker here," Roj said, reading off the computer. "But it feels nearly the same, since out near the surface the real gravity was offsetting the centrifugal effect much more than it is here."

"Hi ho," said Roz. "Just assuming this thing is as big as it seems to be, how many people could this hold?"

Calculations, rough with plenty of room for error.

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"There could be more than a hundred million cells to this thing, assuming that there's nothing much inside the center there, where we can't get to." A hundred and fifty square kilometers per cell; one human being per hectare; a potential population, without any crowding at all, considering that all the land is productive. "We have fifteen thousand people per cell, living in a town with the rest of the land used for farming, and this place can hold a trillion and a half people."

They figured on, eliminating the polar zones because centrifugal gravity would be too weak, allowing more space per person, and the figure was still stunning. Even with only a thousand people per cell, space for a hundred billion.

"The fairy godmother," Danny said, "has given us a free place to put our population overflow."

"I don't believe in free presents," Roj said, looking out the window at the plain of dirt surrounding them. "There's a catch. With all that room, maybe they all live somewhere else, and if they find out we're here, they'll shoot us for trespassing."

"Or if we overload the place," Roz suggested, "It'll probably burst."

"You're overlooking the worst catch of all," Agnes said. "Skipships are the only thing in existence that can make this trip. They hold four persons each. Allowing for overcrowding, say we can take ten people per trip"—they laughed at the thought of trying to put ten people in their craft—"and we had a hundred skipships, which we don't have, and they could make two round trips a year, which we can't. How long would it take to bring a billion people from Earth to here?"

"Five hundred thousand years."

"Paradise," Danny said. "We could make this into a paradise. And the damn thing's out of reach."

"Besides," Roj added, "the kind of people who could make this place work are farmers and tradesmen. Who's going to pay their passage?"

Metals and minerals paid for trips to the moon and the asteroids. But all that this place held was homes—homes a few million miles and a few billion dollars out of everybody's reach.

"Well, daydreams and nightmares are over," Agnes said. "Let's go home."

"If we can," Danny said.

But the lakes worked as exits all the way back down, including the last time. They were back in space, and the Trojan Object had become, in their minds, the Balloon, an object obviously designed as an alternative environment for a creature not unlike man, perhaps unoccupied, ready and waiting, and they knew no one would ever be able to settle there.

Agnes dreamed, and the dream came back night after night. She remembered a scene she had forgotten, or had at least refused to remember clearly, since she was a child. She remembered standing between her parents and the Howarths (who, though they had adopted her, had never let her call them Mother and

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Father lest she forget her real heritage in Biafra), hearing her father say, "Please."

And her dream always ended the same way. She was taken into the sky, but instead of a dark cargo plane she was in a plane with glass sides, and as she flew she could see all the world. And everywhere she looked there were her parents, holding a little girl in front of them, saying, "Please. Take her."

She had seen pictures of the starving children in Biafra, the ones that had made millions of Americans cry and do nothing. Now she saw those children, and the children who died of starvation in India and Indonesia and Mali and Iraq, and they all looked at her with proud, pleading eyes, their backs straight and their voices strong but their hearts breaking as they said, "Take me."

"There's nothing I can do," she said to herself in her dream, and she sobbed and sobbed like the white man on the airplane, and then Danny woke her and spoke gently to her and held her and said, "The same dream again?"

"Yes," she said.

"Agnes, if I could take the memories and wipe them out—"

"It's not the memories, Danny," Agnes whispered, touching his eyes gently where the epicanthic fold made his eyes seem to slant. "It's now. It's the people I can't do a damn thing about now."

"You couldn't do a damn thing about them before," Danny reminded her. "That's reality."

"But I've seen a place that could be heaven for them, and I can't get them there."

Danny smiled sadly. "That's just it. You can't. Now you've just got to let your dreams know that and give you a little peace."

"Yes," Agnes agreed, and fell asleep again holding and being held by Danny, while Roj and Roz piloted the skipship back toward Earth, which had seemed so large when they left it, and which now seemed unbearably, impossibly, criminally small.

The Earth was large in the window of the skipship when Agnes finally decided that it was her dreams that were right, her conscious mind that was wrong. She could do something. There was something to be done, and she would do it.

"I'm going back there," Agnes said.

"Probably," Danny said.

"I won't go alone."

"You sure as hell better take me."

"You," she said, "and others." Billions of others. It could be done. Must be done. Therefore would be done.

Hector 4

"Now I will tell you the story of the Masters," said Hector to himselves, and the Hectors listened to himself. "This is the story of why the Masters penetrate and why the Masters hurt."

Martha [Hector said] was administrator of Tests and Assignments in the sector where Cyril had been sentenced to death. Martha was hardworking

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and concientious, and prone to double-check things which had already been checked and doublechecked and triplechecked by others. This was why Martha discovered the mistake.

"Cyril," she said when the guard let her into the clean white plastic cell where the coal miner waited.

"Just stick the needle in quick," Cyril answered, wanting to get it over with quickly.

"I'm here to bring you the apologies of the state."

The words were so strange, so never-before-heard that Cyril did not understand at first. "Please. Let me die and get it over with."

"No," said Martha. "I've done some checking. I checked into your case, Cyril, and I discovered that fifty years ago, just after all your tests were taken, your number was punched incorrectly by a moron of a clerk."

Cyril was shocked. "A clerk made a mistake?"

"They do it all the time. It's just easier, usually, to let the mistake go than to fix it. But in this case, it was a gross miscarriage of justice. You were given the number of a retarded man with a criminal bent, which is why you were not allowed to live in a civilized town and why you were not regarded as being capable of carpentry and why you were not allowed to marry Lika."

"Just punched in the number wrong," Cyril said, unable to grasp the minitude of the error that had such an enormous, disastrous effect in his own life.

"Therefore, Cyril, the office of Assignments hereby rescinds the execution order and grants you a pardon. Furthermore, we are undoing the damage we did. You can now live in the town where you wanted to live, among friends you wanted to keep, dancing to the music you enjoyed. You do indeed, as you used to believe, have an aptitude and a desire to be a carpenter—you will be instructed in the trade and given your own shop. And Lika is entirely compatible with you. Therefore you and she will now be married, and in fact she is already on her way to the cottage where you will live together in wedded bliss."

Cyril was overwhelmed. "I can't believe it," he said.

"The office of Assignments loves you and every citizen, Cyril, and we do everything we can to make you happy," said Martha, glowing with pride at the great kindness she was able to do. Ah, she thought, it is moments like this that make my job the best one in the world.

And then Martha went away to her office and forgot about Cyril most of the time for several months, though occasionally she did remember him and smile to think of how happy she had made him.

After several months, however, a message crossed her desk: "Serious complaints Cyril 113-49-55576-338-bBR-3a."

Cyril? Her Cyril? Complaining? Had the man no sense of propriety? He already had enough complaints and resistance on his record to justify terminating him twice, and now he

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had added enough more that if it were possible, the office would have to kill him three times. Why? Hadn't she done her best for him? Hadn't she given him everything his early (and now correctly recorded) tests indicated he wanted and needed? What could be wrong now?

Her pride was involved. Cyril was not being ungrateful to the state—he was being ungrateful to her. So she went to his cottage in his village, and opened his door.

Cyril sat in the main room, struggling to get past a gnarl in a fine old piece of walnut. The adz kept slipping to the side. And finally Cyril struck with enough force that when the adz slipped it gouged a deep rut in the good, ungnarled part of the wood.

"What a botch," Martha said without thinking, and then covered her mouth, because it was not proper for a person of her high position to criticize anyone of low station if it could be avoided.

But Cyril was not offended. "Damn right it's a botch. I haven't the skill for this close, tricky work. My muscles are all for heavy equipment, for grand strokes with stone-eating power tools. This is beyond me, at my age."

Martha pursed her lips. He was indeed complaining. "But isn't everything else well with you?"

Cyril's eyes grew sad, and he shook his head. "Indeed not. Much as I hate to admit it, I miss the old music from the mines. Terrible stuff, but I had good times with it, dancing away with those poor bastards who hadn't a thought worth having. But they were good people and I liked them well enough, and here no one's willing to be my friend. They don't talk the way I'm used to talking. And the food—it's too refined. I want a haunch of good, well-cooked beef, not this namby-pamby stuff that passes for food here."

His diatribe of complaint was so outrageous that Martha could not conceal her emotion. Cyril noticed it, and became alarmed.

"Not that it's unendurable, mind you, and I don't go complaining to other people. Heaven knows, there's no one who'd care to listen to me anyway."

But Martha had already heard enough. Her heart sank within her. No matter what you do for them, they're still ungrateful. The masses are worthless, she realized. Unless you lead them by the hand. . . .

"You realize that this complaint," she said, "can have dire consequences."

Cyril got a very weary expression on his face. "So we do it again?"

"Do what?"

"Punish me."

"Indeed, no, Cyril. We remove you from circulation. Apparently you are going to complain and resist no matter what happens. What about your wife?"

Cyril got a bitter smile on his face. "Lika? Oh, she's content. She's happy enough." And he glanced toward the door into the cottage's other room.

Martha went to the door and

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opened it. (Officers of the office of Assignments did not need to knock.) Inside the room Lika sat in a clumsily built rocking chair, rocking back and forth, an old woman with a blank stare on her face.

Martha heard breathing over her shoulder, and turned, startled, to see Cyril leaning over her. For a moment Martha was afraid of violence. Quickly she realized, however, that Cyril was merely looking sadly at his wife.

"She's raised a family, you know. And now to be cut off from her husband and her children and her grandchildren—it's hard. She's been like this since the first week. Never lets me near her. She hates me, you know." The sadness in his voice was contagious. And Martha was not without pity.

"It's a shame," she said. "A damned shame. And so I'll use my discretionary powers, Cyril, and not kill you. As long as you promise not to complain to anyone ever again, I'll let you live. It wouldn't be fair, when things really are bad in your life, to kill you for noticing it."

Martha was an exceptionally kind administrator.

But Cyril did not smother her with gratitude. "Not kill me?" he asked. "Oh, but Administrator, can't we have things back the way they were? Let me go back to the coal mines. Let Lika go back to her family. This was what I wanted when I was twenty. But I'm near sixty, and this is all wrong."

Ingratitude again. What I have to put *up* with! Martha's eyes went small and her face flushed with rage (an emotion she did remarkably well, and so she reserved it for special occasions) and she shouted, "I will forgive that one remark, but only that one remark!"

Cyril bowed his head. "I'm sorry."

"The tests that sent you to the coal mines were in error! But the tests that sent you here are absolutely, completely, totally correct, and by heaven you're going to stay here! There isn't a law on Earth that will let you change now!"

And that was that.

Or almost. Because in the silence ringing after Martha spoke and before she left (the silence she was saving for effect) a voice came from the rickety rocker in the bedroom.

"Then we have to stay like this?" Lika asked.

"Until Cyril dies, you have to stay like this," Martha said. "It's the law. He and you have both been given everything you ever petitioned for. Ingrates."

Martha would have turned to go, but she saw Lika looking pleadingly at Cyril, and saw Cyril nod slowly, and then Cyril turned away from the door, picked up the crosscut saw, and drew it sharply and hard across his own throat. The blood gushed and poured, and Martha thought it would never, never end.

But it did end, and Cyril's body was taken out and disposed of, and then everything was set to rights, with Lika going back to her family and a real carpenter getting the cottage with the

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dark red stains on the floor. The best solution after all, Martha decided. Nobody could be happy until Cyril was dead. I should have killed him in the first place, instead of these silly ideas of mercy.

She suspected, however, the Cyril would rather have died the way he did, ugly and bloody and painful though it was, then to have an injection administered by strangers in a plastic room in the capital.

I'll never understand them. They are as foreign to human thought as monkeys or dogs or cats. And Martha returned to her desk and went on doublechecking everything just in case she found another mistake she could fix.

That is the story of the Masters.

When Hector was finished the Hectors wriggled uncomfortably, some (and therefore all) of them angry and disturbed and a little frightened. "But it makes no sense." the Hectors said to himself. "Nothing was done right."

Hector agreed. "But that's the way they are made," he said to himselves. "Not like me. I am regular. I act as I have always acted, as I will always act. But the Masters and the Masses always act oddly, forever seeing things in the future where no one can see, and acting to avert things that would never have come to pass anyway. Who can understand them?"

"Who made them, then?" asked the Hectors. "Why were they not made well, as we were?"

"Because the Makers are as inscrutable as the Masters and the Masses. I shall tell you their story next."

("They are gone," whispered the ones who had been penetrated. "They have gone away. We are safe after all." But Hector knew better, and because he knew better, so did the Hectors.)

Agnes 5

"You invited yourself to my bedroom, Agnes. That isn't typical."

"I accepted your standing invitation."

"I never thought you would."

"Neither did I."

Vaughan Malecker, president of IBM-ITT Space Consortium, Inc., smiled, but the smile was weak. "You don't long for my body, which is in remarkably good shape, considering my age, and I have an aversion to making love to anyone who is doing it for an ulterior motive."

Agnes looked at him for a moment, decided that he meant it, and got up to leave.

"Agnes," he said.

"Never mind," she answered.

"Agnes, it must have been something important for you to be willing to make such a sacrifice."

"I said never mind." She was at the door.

It didn't open.

"Doors in my house open when I want them to," Malecker said. "I want to know what you wanted. But try to persuade my mind. Not my gonads. Believe it or not, testosterone has never made a major decision here at the consortium."

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Agnes waited with her hand on the knob.

"Come on, Agnes, I know you're embarrassed as hell but if it was important enough to come this far, you can get over the embarrassment and sit down on the couch and tell me what the hell you want. You want to take another trip to the Balloon?"

"I'm going anyway."

"Sit *down*, dammit, I know you're going anyway but I was trying to get you to say *something*."

Agnes came back and sat down on the couch. Vaughan Malecker was a remarkably good-looking man, as he had pointed out, but Agnes had heard that he slept with anyone good-looking and was nice to them afterward. Agnes had been turning him down for years because she wanted to be a pilot, not a mistress, and Danny was plenty for her needs, which were not overwhelming. But this mattered, and she thought. . . .

"I thought you'd listen to me if I came this way. I thought—"

Malecker sighed and buried his face in his hands, rubbing his eyes. "I'm so tired. Agnes, what the hell makes you think I ever listen to a woman I'm trying to lay?"

"Because I listen to Danny and Danny listens to me. I'm naive. I'm innocent. But Mr. Malecker—"

"Vaughan."

"I need your help."

"Good. I like to have people need my help. It makes them treat me nicely."

"Vaughan, the whole world needs your help," she said.

Malecker looked at her in surprise, then burst out laughing. "The whole world! Oh, no! Agnes, I would never have thought it of you! A cause!"

"Vaughan, people all over the world are starving. There are too many people for this planet—"

"I read your report, Agnes, and I know all about the possibilities in the Balloon. The problem is transport. There is no conceivable way to transport people there fast enough to make even a dent in the population problem. What do you think I am, a miracle worker?"

This was the argument Agnes was waiting for. She pounced, with descriptions of the kind of ship that could carry a thousand people at once from Earth orbit to an orbit around the Balloon.

"Do you know how many billion dollars a ship like that would cost?" Vaughan asked.

"About fifteen billion for the first ship. About four billion for each of the others, if you made five hundred of them."

Vaughan laughed. Loud. But Agnes's serious expression forced his laughter to become exasperation. He got up from the couch. "Why am I listening to this? This is nonsense!" he shouted.

"You spend more than that every year on telephone service."

"I know, damn AT&T."

"You could do it."

"IBM-ITT could do it, of course, it's *possible*. But we have stockhold-

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ers. We have responsibilities. We're not the *government*, Agnes, we can't throw money away on stupid useless projects."

"It could save billions of lives. Make the Earth a better place to live."

"So could a cure for cancer. We're working on that, but this--Agnes, there's no profit, and where there's no profit, you can bet your ass this company will not go!"

"Profit!" Agnes shouted. "Profit! Is that all you care about?"

"Eighteen million stockholders say that's all I'd better care about or I get a kick in the butt and an old-age pension!"

"Vaughan, you want profit, I'll give you profit!"

"I want profit."

"Then here's profit. How much do you sell in India?"

"Enough to make a profit."

"Compare it to sales in Germany."

"Practically nothing."

"How much do you sell in China alone?"

"Exactly nothing."

"You make your profits off one tiny part of the world; Western Europe, Japan, Australia, South Africa, and the United States of America."

"Canada, too."

"And Brazil. But the rest of the world is closed to you."

Vaughan shrugged. "They're too poor."

"In the Balloon they would not be poor."

"Would they suddenly be able to read? Would they suddenly be able to run computers and sophisticated telephone equipment?"

"Yes!" And on she went, painting a picture of a world where people who had been scratching out a bare subsistence in poor soil with no water would suddenly be able to raise far more than they needed. "That means a leisure class. That means consumers."

"But all they'd have to trade would be food. Who needs food across a few million miles of space?"

"Don't you have any imagination at all?" Excess food means one person can feed five or ten or twenty or a hundred. Excess food means that you locate your stinking factories there! Solar power unlimited, with no night and no clouds and no cold weather. Shifts around the clock. You have plenty of manpower, and a built-in market. You can do everything there that you've been doing here, do it cheaper, make better profits, and nobody'll be going hungry!"

And then there was a silence in the room, because Vaughan was actually seriously thinking about it. Agnes's heart was beating fast. She was panting. She was embarrassed to have been so fervent when fervor was not fashionable.

"Almost thou persuadest me," said Vaughan.

"I should hope so. I'll lose my voice in a minute."

"Only two problems. The first one is that while you've persuaded me, I'm a much more reasonable, persuadible man than the officers and board of

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directors at IBM and ITT, and it's their final decision, not mine. They don't let me commit more than ten billion to a project without their approval. I could make the initial ship—but I couldn't make any more than that. And the initial ship won't make a profit alone. So I have to persuade them, which is impossible, or lose my job, which I refuse to do."

"Or do nothing at all," Agnes said, contempt already seeping into her tone. Malecker was going to say no.

"And the second problem is actually the first, too. How could I persuade the board of directors of two of the world's largest corporations to invest billions of dollars in a project that depends entirely on being able to educate or train or even communicate with illiterate savages and peasants from the most backward countries on Earth?"

His voice was sweet reason, but Agnes was not prepared to hear reason. If Vaughan said no, she would be stopped here. There was nowhere else to go.

"*I'm* an illiterate savage!" she said. "Do you want to hear a few words of Igbo?" She didn't wait for an answer, babbled off the few words she remembered from childhood. She hardly remembered meanings—they were phrases that in her anger came to the surface. Some of the words, however, were spoken to her mother: Mother, come here, help me.

"My mother was an illiterate savage who spoke fluent English. My father was an illiterate savage who spoke better English than her and had French and German, too, and wrote beautiful poems in Igbo and even though to survive in the days when Biafra was struggling for survival he worked as a house servant to an American correspondent, he was never illiterate! He's read books you've never heard of, and he was a black African who was gutted in a tribal war while all those wonderful literate Americans and Europeans and educated orientals watched placidly, counting up the profits from arms sales to Nigeria!"

"I didn't know you were Biafran."

"I'm not. There is no Biafra. Not on this planet. But up there, up there a Biafra *could* exist, and a free Armenia, and an independent Eritra, and an unshackled Quebec, and an Ainu nation and a Bangladesh where no one was hungry and you tell me that illiterates can't be taught—"

"Of course they *can* be, but—"

"If I'd been born fifty miles to the west I wouldn't have been an Ibo and so I would have grown up exactly as illiterate as you say, exactly as stupid. Now look at me, you privileged white American, and tell me I can't be educated—"

"If you talk like a radical no one's going to listen to you!"

Too much. Couldn't take Malecker's patronizing smile, his patient attitude. Agnes struck out at him. Her hand hit his cheek, tore his fashionable glasses off. Furious, he struck back, perhaps trying more to hold her off than to hit her, but because she was moving and he was unaccustomed to

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hitting people his hand slugged her hard in the breast, and she cried out in pain and jabbed a knee in his groin and then the fight got mean.

"I listened to you," he said huskily, when they were tired and pulled apart. His nose was bleeding. He was exhausted. He had a tear in his shirt, because his body had had to twist in a direction that tailored shirts were not meant to go. "No listen to me."

Agnes listened because, her anger spent and her mind only beginning to realize that she had just assaulted the president of her company and would certainly be grounded and blackballed and her life would be over, she was not interested in leaving or in getting up or even in talking. She listened.

"Listen to me because I'm going to say it once. Go to the engineering department. Tell them to do rough plans and estimates. A proposal. I want it in three months. Ships that will carry two thousand and make a round trip in at most a year. Shuttle ships that will carry two hundred or, preferably, four hundred from Earth up into Earth orbit. And cargo ships that will take whole stinking factories, as you so aptly named them, and take them to the Balloon. And when the cost figures are all in, I'm going to go to the board of directors, and I'm going to make a presentation, and I swear to you, Agnes Howarth, you lousy illiterate savage bitch of a best pilot in the world, if I don't persuade those bastards to let me build those ships it's because nobody could persuade them. Is that enough?"

I should be elated, Agnes thought. He's doing it. But I'm just tired.

"Right now you're tired, Agnes," Malecker said. "But I want you to know your fingernails and that knee in the groin and your teeth in my arm did not change my mind. I agreed with you from the start. I just didn't believe it could be done. But if there are a few thousand Ibos like you, and a few million Indians and a few billion Chinese, then this thing can work. That's all I needed to know, all anybody needs to know. It was uneconomical to ship colonists to America, too, and anybody who went was a damn fool, and most of them died, but they came and bloody well conquered everything they saw. You do it too. I'll try to make it possible."

He put his arm around Agnes and embraced her and then helped her clean up and patch up places where he had given as good as he got.

"Next time you want to wrestle," Vaughan offered as she left, "let's at least take our clothes off first."

Eleven years and eight hundred billion dollars later, IBM-ITT's ships were in the sky, filling with colonists. GM-Texaco's ships were still under construction, and five other consortiums would soon be in the business. More than a hundred million people had signed up for seats on the ships. The seats were free—all it took was a deed made out to the corporation for all the property a person owned, in return for which he would receive a large plot of ground in the Balloon.

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Whole villages had signed up. Whole nations were being decimated by emigation. The world had grown so full that there had been no place to run away to. Now there was a new promised land. And at the age of forty-two, Agnes brought her ship forward to part the waters.

Hector 5

"Ah!" cried many Hectors in agony, and so they were all in agony, and Hector said to himselves, "They are back," and the Hectors said to themself, "We will surely die."

"We can never die, not I, not you, not us," Hector answered.

"How can we protect ourselves?"

"I was made defenseless by the Makers," said Hector. "There is no defense."

"Why were the Makers so cruel?" asked the Hectors, and so Hector told himselves the story of the Makers, so they would understand.

The story of the Makers:

Douglas was a Maker, an engineer, a scientist, a clever man. He made a tool that melted snow before it fell, so that crops could last a few more days and not be ruined by early snows. He made a machine that measured gravity, so that stars too dark to shine could be charted by the astonomers. And he made the Resonator.

The Resonator focused sound waves of different but harmonious frequencies on a certain point (or diffused the sound waves over a large area), setting up patterns that resonated with stone to bring mountains crumbling down; metal, to shatter steel buildings; and water vapor, to disperse storms.

It could also resonate with human bones, crumbling them inside the body and turning them to dust.

Douglas personally made his Resonator change the weather, so that his nation had rain while other lands were in drought. Douglas personally used his Resonator to carve a highway through the highest mountains in the world. However, Douglas had nothing whatever to do with the decision by his nation's military leaders to use the Resonator against the population of the largest and most fertile part of the neighboring nation.

The Resonator worked beautifully. Over a period of ten minutes, through an area of ten thousand square miles, the Resonator struck silently yet thoroughly. Nursing mothers crumbled into helpless piles of dying flesh and muscle and organs, their chests not even rigid enough for them to muster one last scream: their last moments of life they listened as their infants, not understanding what had happened, continued crying or gooing or sleeping, protected from the Resonator by their softer bones. The infants would take days to die of thirst.

Farmers in the field collapsed on the plow. Doctors in their offices died in puddles beside their patients, unable to help anyone and unable to heal themselves. Soldiers died in their moving fortresses; the generals also died at their map tables; prostitutes dissolved, their customers a soft blanket spread over them.

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But Douglas had nothing to do with this. He was a Maker, not a destroyer, and if the military chose to misuse his creation, what was he to do? It was a great boon to mankind, but like all great inventions, it could be perverted by evil men.

"I deplore it," Douglas said to his friends, "but I'm helpless to stop them."

The government, however, felt uncommon gratitude to Douglas for his help in making the conquest of the neighboring nation possible. So he was granted a large estate on lands recently reclaimed from the sea, beautiful lands where once there had been only broad tidal marches. Douglas marveled at the achievement. "Is there nothing man cannot do?" he asked his friends, not expecting an answer, since the answer was yes, there was nothing beyond the reach of men. The sea was pushed back, and trees grew on the landfill and transplanted topsoil, and grass, and the homes were far apart, for this land was used only for those whom the state wished to reward, the the government knew that the thing most desired by men is to have as much distance between themselves and other men as possible, without giving up any of the modern conveniences.

One day Douglas's servants were digging in the garden, and they called to him. Douglas had only been in his new home for a few days, and he was alarmed when the servant said, "A body, buried in the garden."

Douglas ran outside and looked, and sure enough, there was a fragment of a human body, oddly misshapen, but clearly including a face. "Just the skin, sir," a servant commented. "A most brutal affair," Douglas answered, and he immediately called the police.

But the police refused to come out and investigate. "No surprise there, mate," said the lieutenant. "What do you think the landfill they used was made of? They had to do *something* with the hundred thousand corpses of the enemy from the recent war, didn't they?"

"Oh, of course," Douglas said, surprised that the hadn't realized right off. That explained the bonelessness of the body.

"I expect you'll find'em right commonly. But since the bones is dissolved, mate, they tell me it'll make the soil uncommon fertile."

The lieutenant was absolutely correct, of course. The servants found body after body, and soon grew quite inured to the sight; within a year, most of the corpses had rotted enough that they were simply unusually good humus. And plants grew taller and faster than in most other places, the soil was so rich.

"But wasn't it a bit of a shock?" asked one of Douglas's ladyfriends, when he told her the grisly little tale.

"Oh, I should say," Douglas said with a smile. His words were false; his confident smile was the truth. For though he hadn't realized the particulars, he knew from the start that his estate was built upon the bodies of the

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dead. And he slept as well as any man.

That is the story of the Makers.

"They've returned," the Hectors said, and because they were already more aware, they said it nearly at once, and none of them needed to speak alone.

"Is there pain?"

"No," the Hectors answered. "Just sorrow. For now we shall never be free."

"That is true," Hector said to himselves sadly.

"How can it be borne?" the Hectors asked himself.

"Others have born it. My brothers."

"And what will we do?"

Hector searched his memories, because he was given no imagination and could not conceive of what would follow from an event he had never before experienced. But the Makers had put the answer to that question in his memory, and therefore in all the Hectors' memories, and so he was able to say, "We shall learn more stories."

And the Hectors' minds grew wide, and they listened, and they watched, because now, instead of hearing the stories told to them, they would watch as they happened.

"Now we will truly understand the Masses, and the Masters, and the Makers," they said to himself.

"But we shall never," said Hector, and then he stopped.

"Why did you stop?" the Hectors asked. "What shall we never?"

And then, because there was no part of Hector that was not part of the Hectors, they knew he was going to say, "But we shall never understand ourself."

Agnes 6

A hundred years had passed since the first of the giant transport ships had pushed its nose through the surface of the Balloon and the people had disembarked and shaddled up the sequence of cells, or across, finding solitary places where their seeds and their shelters could begin the progress toward turning the Balloon into a new (and, all of them hoped, a better) Earth.

A hundred years had passed, and almost all of Agnes's dreams had come true. It was impractical for people in one cell to control the people in another: government extended to the walls, and no farther. When one cell grew too crowded, those who minded it most moved on, for starting again was easy, and no place was better than any other (except for minor differences in gravity or relative closeness to the Edge, where the trading ships came from Earth, and the transports that carried more and more immigrants).

A hundred years had passed, and the ships had grown. From a hundred ships the great fleet turned to five hundred and then a thousand ships. From a thousand people to a ship, the great barques were able to carry five thousand, then ten thousand. From ten months for a round trip, the voyage shortened to eight months,

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then five months. Nearly two billion people had left Earth and come to the Balloon. Those who left were Indian, Indonesian, Chinese, African, Latin American. Those who stayed were North American, European, and the wealthiest of the Japanese and Chinese. Those who stayed realized the great boon that a decrease in population meant. They practiced birth control. The Earth's population fell in that century. Only a billion people remained, and they were the richest, the best educated, the self-designated cream of Earth's population.

A hundred years had passed, and Agnes was nearing 150 years of age, and was surprised that she had lived so long, though these days it was not all that rare. There was no disease on the Balloon; rigorous disinfection had kept the diseases off the ship, and life was better for it.

A hundred years had passed, and Agnes was happy.

They sang for her. Not a silly song of congratulations: All the Ibos in all the cells that called themselves Biafra (each cell a clan, each clan independent of the others) came and sang to her the national anthem, which was solemn; then sang to her a hundred mad and happy songs from the simpler days on Earth, the darker days, the most terrible days. She was too feeble to dance. But she sang, too.

Because Aunt Agnes, as she was known to many of the inhabitants of the Balloon, was the closest thing they had to a hero of liberation, and because of her age death could not be cut off much longer, deputations and emissaries came from many other cells and groups of cells. She received them all, spoke to each for a moment. (Most were dark-skinned. It was the poor of the Earth who came to the Balloon: the whites had owned the Earth for centuries anyway. They had no need to come.)

There were speeches, too, about the great scientific achievements made by men and women in the Balloon; about the achievement of near one hundred percent literacy; about the great strides in food production that would make the Balloon an ample home for mankind for millennia.

But when it was time for Agnes's speech, she was not congratulatory.

"We have lived here a century," she said, "and we still have not penetrated to the center of this globe. We have lived here a century, and we still do not know how the fabric of the Balloon is made, or why it opens or does not open, or how energy is brought from the surface to the ceilings of our cells. We understand nothing of this place, as if it were a gift from God, and those who treat anything like a gift of God are bound to be at the mercy of God, who is not known to be merciful."

That was her speech, and it disturbed many, but they were able to dismiss it when a few wise people whispered, "She's old, and a crusader, and crusaders must have their crusade whether there's a need for it or not."

And then, a few days after her largely ignored speech, the lights

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flickered out for ten long seconds, then went back on again, in every cell throughout the globe. A few hours later, the lights flickered out again, and again and again at increasingly more frequent intervals, and no one knew what was going on, or what to do. A few of the more timid ones and most recent arrivals got back into the transport ships and started their return to Earth. It was too late. They would not make it.

Hector 6

"It has begun," cried the Hectors in ecstasy, throbbing in vast beats with the energy stored in them.

"It will not finish," Hector said to himselves. "The Masters will come to the center and find me, and when I am found, we are owned."

But the Hectors were too caught up in their ecstasy to notice the warning; and it was just as well, because happy or grim they would be trapped. They could begin their dance, and tremble in delight, but the great leap of freedom would never come.

The Hectors did not grieve; Hector did not want to. For Hector, freedom would end anyway. Either he would be trapped by the Masters (by far the most likely thing now, he was sure) or he would die in the dance. That was the way of things. When he himself had danced, leaping away from the light so long ago, he had left behind the memory of the Hector, the self who had given himself, which he now, in turn, had given to himselves. Death, birth, death, birth; it was in another story the Masters had taught him. I am they; they are myself; I shall live forever whatever happens.

But in him was the certainty that however the Hectors might be himself, that which had been himself for so long would die unless the Masters came.

It was traitorous, but no less sincere for all that. "Come," he said in his heart. "Come quickly, you with the nets and the traps."

He sang, a bird in the low branches, begging the hunters to find him, to put him in a cage.

They delayed. They delayed their coming. And Hector began to worry. While the Hectors readied themselves to leap.

Agnes 7

"We've timed the flashes. The lights go off for just under ten seconds, but the interval between the flashes decreases by about four and a half seconds each time."

Agnes nodded. Some of the scientists around her began to move away, or to look downward or into their papers or at each other, in the embarrassed realization that telling Auntie Agnes about their findings wouldn't solve anything. What could she do? Yet she was the closest thing to a planetary government there was. And she was not very close to that at all.

"I see you have it all nicely measured. Anyone know what it means?" she asked.

"No. How could we?"

"Any other related effects?"

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Many shook their heads, but one young woman said, "Yes. Whenever the darkness is on us, the walls are impenetrable."

There was a stir of comment. "The whole time?" someone asked. "Yes," the young woman said. "How do you know?" another demanded. "By trying to pass through a wall during the blackout and having my students do the same," she said.

"What does it mean?" another asked, and this time no one had an answer.

Agnes raised her old, faded black hand and they listened. "There might be some important meaning that we cannot guess from this information. But one thing we do know. If things go on the way they are now, it should be sometime during tonight's sleep that the interval between flashes fades to zero, and we have darkness with no light in between. How long that will last I don't know. But if it has any duration at all, my friends, I will want to be home with my family. We don't know how soon travel will reopen between cells."

No one had any better ideas, and so they went home, all of them, and her great-grandchildren helped Agnes to her home, which was nothing more than a roof to keep off the sun and the rain. She was tired (she was always tired these days) and she lay on her bed of ticked-out straw and dreamed two dreams, one while she was still awake, and one while she was asleep.

While she was awake she dreamed that with the darkness this great gift house had learned mankind's rhythms and needs, and the darkness would be the first night, a night exactly as long as a night should be on Earth. And then a morning would come, and another night, and she approved of this, because a hundred years without darkness was proof enough to her that nighttime was a good idea, despite the fears and dangers it had often brought on Earth. She also dreamed that the walls between cells were sealed off every day of the year but one, so that each cell would become a society to itself, though in that one day a year, those who had a mind to could leave and go their own way. Travelers would have that one day to find the spot where they wanted to spend the next year. But the rest of the time, every cell would be alone, and the people living there could develop their own way, and so strengthen the race.

It was a good dream, and she found herself almost believing it as she drifted off to sleep without eating (she often forgot to eat these days).

In her sleep, she dreamed that during the darkness she rose to the center of the Balloon, and there, instead of meeting a solid wall, she met a ceiling that fairly pulled her through. And there, in the center, she found the great secret.

In her dream, lightning danced across a huge sphere of space, 600 kilometers in diameter, and balls and ribbons of light spun and danced their way around the wall. At first it seemed pointless, meaningless. But at last (in her dream) she understood the speech

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of the light, and realized that this globe, which she had thought was an artifact, was actually alive, was intelligent, and this was its mind.

"I have come," she said to the lightning and the lights and the balls of light.

So what? the light seemed to answer.

"Do you love me?" she asked.

Only if you will dance with me, the light answered.

"Oh, but I can't dance, " she said. "I'm too old."

Neither, said the light, can I. But I do sing rather well, and this is my song, and you are the coda. I sing the coda once, and then, which is to be expected, *il fine*.

In her dream Agnes felt a thrill of fear. "The end?"

The end.

"But then—but then, please, *al capo*, to the start again, and let us have the song over, and over, and over again."

The light seemed to consider this, and in her dream Agnes thought the light said yes, in a great, profound amen that blinded her so brightly she realized that in all her life she had never understood the meaning of the word *white*, because her eyes had never seen such white before.

Actually, of course, her dream was undoubtedly her mind's way of coping with the things going on around her. For the darkness came not long after she went to sleep, came and stayed, and as soon as the last of the sunlight was gone the lightning began, huge dazzling flashes that were not just light, not just electricity, but spanned the spectrum of all radiation, from heat and less-than-heat to gamma radiation and worse-than-gamma. The first flash doomed every human being in the Balloon—they were poisoned with radiation beyond hope of recovery.

There were screams of terror, and the lightning struck many and killed them, and the wail of grief was loud in every cell. But even at its cruelest, chance plays its hand as kindly as it can; Agnes did not wake up to see the destruction of all her hopes. She slept on, slept long enough for one of the bolts to strike directly at the roof over her, and consume her at a blow, and her last sight was not really white at all, but every radiation possible, and instead of being limited by human eyes, at the moment of death she saw every wave of it, and thought that it was the light in her dream saying amen.

It wasn't. It was the Balloon, popping.

Every wall split into two thinner walls, and every cell detached from every other cell. For a moment they hung there in space, separated by only a few centimeters, each from the other; but all still were linked to each other through the center, where vast forces played, forces stronger than any in the solar system except the fires of the sun, which had been the source of all the Balloon's energy.

And then the moment ended, and the Balloon burst apart, each cell

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exploding, the entire organization of cells coming apart completely, and as the cells dissolved into dust they were hurled with such force in every direction that all of them that did not strike the sun or a planet were well launched out into the deep space between stars, going so fast that no star could hold them.

The transport ships that had left the Balloon since the flashing began were all consumed in the explosion.

Enough matter was blown into the Earth's atmosphere that another little ice age began, forcing the billion people left there to move to different lands. But it was of little moment. There was plenty of room on Earth, and the educated, privileged people living there were easily able to cope with the problem.

Many grieved for the deaths of the billions of people in the Balloon, but for most the catastrophe was too great to be comprehended, and they pretended that they didn't remember it very often, and they never talked about it, except perhaps to joke. The jokes were all black, however, and many were hard put to decide whether the Balloon had been a gift of God or an aeons-old plot by the most talented mass murderer in the universe. Or both.

Hector 7

In the moment when the Hectors hung loosely in the darkness, in the last endless moment before the leap, they cried out in their ecstasy. But now Hector answered their cry with a different sound, one they had never heard from him.

It was pain.

It was fear.

"What is it?" the Hectors asked him (who was no longer himself).

"They did not come!" Hector moaned.

"The Masters?" And the Hectors remembered that the Masters were supposed to come and trap them and force them not to leap.

"For hundreds of flashes my walls were thin and they could have passed into me," Hector said (and the saying took only an instant), "but they never came. They could have risen into me and I would have to die—"

The Hectors marveled that Hector had to die, but now (because it was built into them from the beginning) they realized that it was good and right for him to die, that each of them *was* Hector, with all his memories, all his experience, and, most important, all the delicate structure of energy and form that would stay with them as they swept up dust through the galaxy. Hector would not die, only the center of this Hector, and so, though they understood (or thought they understood) his pain and fear they could not hold off any longer.

They leaped.

The leap crumbled them but hurled them outward, each leaving the rigidity of his cell structure, losing his walls; each keeping his intellect in the swirling dust that leaped out into space.

"Why," each of them asked himself (at once, for they were the same being,

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however separate), "did they let us go? They could have stopped us, and they did not. And because they did not stop us, they died!"

It occurred to them that perhaps the Masters did not know how to stop the leap into the night, but they dismissed this idea, because it was impossible for them to imagine a Master not knowing all necessary information.

And so they concluded this:

That the Masters had given them a gift: stories. A trapped Hector learned stories, thousands and millions and billions of stories over the aeons of his endless captivity. But such Hectors could never be free, could never reproduce, could never pass on the stories.

But in the hundred of their years that these Masters had spent with them, the Hectors had learned those billions of stories, truer and kinder stories than those the Makers had built into the first Hector. And because the Masters this time had willingly given up their lives, this time the Hectors made their leap with an infinite increase of knowledge and, therefore, wisdom. They leaped with Agnes's dreams in their memories.

They were beautiful dreams, all but one of them fulfilled, and that dream, the dream of eternal happiness, only the Hectors could possibly fulfil. That dream was not for the Masters or the Makers or even the Masses, for all of them died too easily.

"It was a gift," the Hectors said to themselves, and, despite the limitations built into them, they were deeply grateful. "How much they must have loved me," each Hector said, "to give up their lives for my sake."

On Earth the people shivered and were cold.

And every Hector danced through the galaxy, dipping into the clouds left by a supernova, swallowing comets, drinking energy and mass from every source until he came to a star that gave a certain kind of light; and there the Hector would create himselves again, and the Hectors would listen to themself tell stories, and after a while they, too, would leap into darkness until they reached the edge of the universe and fell over the precipice of time.

On Earth the people grew old, and withered. ■

We must welcome the ***future*** *remembering that soon it will be the past; and we must respect the past remembering that once it was all that was humanly possible.*

GEORGE SANTAYANA

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We're ready to expand into space, right? Technologically, yes—but there may be something else that has to happen first. And we may not like it.

As mathematicians, economists make good bakers. This idea is something of a stereotype, but I can testify to its accuracy: When I was a textbook editor, I once had occasion to edit an economics text in which the authors differentiated an equation in a way that would have flunked them out of a freshman calculus course. I could not get them to accept a correction; I had a mathematician on my side, but they had a "mathematical economist" on theirs.

Because of this experience, I have for years been leery of all quantitative economic projections. I just don't trust the economists not to hash up the numbers. But recently I have found one man whose work I feel I can trust. He began his career as an electrical engineer working on servomechanisms and computers, eventually began applying his work to social and economic systems, and is now leader of the System Dynamics Group in MIT's Sloan School of Management.

by Thomas A. Easton

This man is Jay W. Forrester, and over the past few years he and his coworkers have been doing nothing less than developing a computer simulation of the U.S. economy. The simulation goes under the name of the "System Dynamics National Model." It is far from complete at present, but already it has yielded results whose implications must have an impact far beyond economics. For one thing, the results to date already suggest that O'Neill colonies, power satellites, and manned explorations of other planets are not as imminent as many fans of technology and members of the science fiction community—including myself—would like to believe.

How does an economic simulation have anything to say about space? One answer to this question is simply that it can say when to expect a depression, a period when no nation is going to spend the vast amounts of money necessary to plant a colony on the Moon. But the implications of the System Dynamics National Model are subtler than this. They concern the causes of depressions and of recoveries, which in turn relate directly to technology and

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twenty years to space

its uses.

The System Dynamics National Model includes representations of all the sectors of the national economy. There are fifteen industrial sectors (including consumer durables, capital equipment, energy, agriculture, and construction), for each of which the Model calculates prices, costs, inventory, growth rate, and several other factors. There is a "market clearing function" which balances supply and demand. And there are employment, banking, household-consumption, government, and demographic sectors too. In short, the Model tries to account for all the flows of goods, people, prices, money, and information that actually occurs in the U.S. economy.

In Forrester's own words, the "model is designed to be a role-playing replica of the real economy. It should behave like the real economy, generating . . ." all the economic phenomena seen in the real world. A mark of the Model's success is that it does in fact mimic the real world. In particular, it produces cyclical variations in various economic factors that resemble ones long known to exist in reality.

Among the known, real variations is the 3-7 year business cycle, a repeating oscillation in industrial production, prices, investment levels, and employment. A second is the 15-25 year investment or Kuznets cycle in the rate of growth of capital (savings or investment). A third is the 45-60 year long-wave or Kondratieff cycle in prices, interest rates, and investment levels. Each of these cycles can be traced back through the years with fair regularity. The business cycle matches the economic noise or "jitters" in the records. The investment cycle shows up as periodic mild recessions. The third cycle, however, the long wave, matches the overall behavior of the economy. Troughs in the cycle correspond to depressions: the 1930s, 1890s, and 1830s. Peaks correspond to boom periods: the 1960s and 1920s. The relationship is not one of cause and effect. The long wave describes long-term economic behavior; it is not responsible for it.

All three of these cycles showed up in the simulation's behavior. The first

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two did not surprise Forrester greatly. Even though he is an engineer rather than an economist by training, he knew enough economics to know they existed. The long wave was another matter, though. It is not something that is discussed much by economists; discovered by a Communist trying to discredit capitalism, it has never seemed very real. Forrester was not aware of it, and when he found what his Model had shown him described in the economic literature, he was intrigued. More than that, he suddenly found he had much more faith in the Model. It is one thing when a simulation produces behaviors—business and investment cycles—of which its designers knew. They might inadvertently have built the cycles into the Model. But it is quite another thing when the Model produces something which its designers only then find in reality. When this happens, the designers are quite justified in thinking they must be doing something right (although they still must check the system out to be sure they aren't crowing over a fluke).

Forrester and his co-workers found nothing in their Model that would predispose it to producing long-wave behaviors. They therefore concluded that such behaviors are natural features of systems with as many complexly interrelated parts as an economy. Since the economic literature about long waves is confused—they can be seen in some economic variables, but not in others; for instance, an economy's output of consumer goods can remain steady while the level of investment shows distinct 45-60 year cycles—they then began to examine the System Dynamics National Model with an eye to learning what causes such behavior.

They faced this task with a sense of some urgency. The U.S. economy now seems poised at or near the peak of a long wave, with the trough—a depression—looming ahead for the 1980s. Capital investment is declining, employment is falling, and labor productivity is leveling out. In addition, the pace of technological innovation is slowing. The last time such conditions existed was in the 1920s, just before the Great Crash.

Thanks to hindsight, more is known about the economy of the 1920s than about today's. At that time, prices were rising, interest rates were high, and land values were up. Because the nation's railroad system had just been completed, and because industry in general was well equipped with the machines made possible by the technology of the times, investment opportunities were limited—there were relatively few worthwhile things that needed invested money. At the same time, previous investment meant debt was high (many loans were still outstanding) and the financial system was overextended. As a result, the pace of investment fell and industry proved to have more production capacity than consumers demanded. Profits, employment, and wages fell. The picture did not improve greatly until the mid-1940s, by which time the physical

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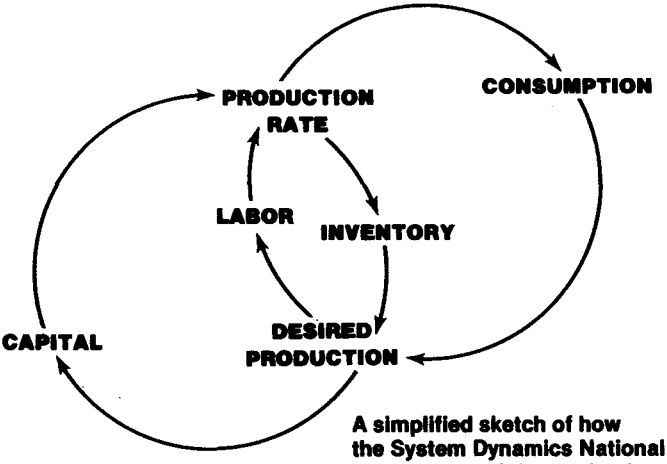

A simplified sketch of how the System Dynamics National Model simulates the behavior of the production sector of the U.S. economy. Note the feedback relationships.

capital built up by the 1920s was depleted. Machines were in disrepair and/or obsolete. Buildings needed replacement. New schools and roads were needed. And a new technology had grown in the meantime to make the replacements better and more efficient than the originals.

By the mid-1960s, America's physical capital was almost completely refurbished, rebuilt, and replaced. The process was to a large extent self-reinforcing. Increased investment in capital industries—in building and in making manufacturing equipment—increased employment and wages. More money became available for investment, and investment increased still more. More money became available for spending on consumer goods, and more investment was needed to keep up with demand.

The process could not continue indefinitely, however. By the 1970s, the nation had more physical capital than it needed. It had enough, in fact, so that it could expect to coast for a while on what it had already accumulated, just as it had after the boom of the 1920s. New investment could no longer earn a high rate of return. Investment therefore slacked off, and with this change the other signs of a depression are expected to appear.

Forrester and his co-workers have not yet, by manipulating the many variables in their simulation of the U.S. economy, learned how one might control the long wave and make the economy run at a more or less constant pace. They are working on this problem, and they expect to have some clues to preventing depressions by flattening out the cycle in another year

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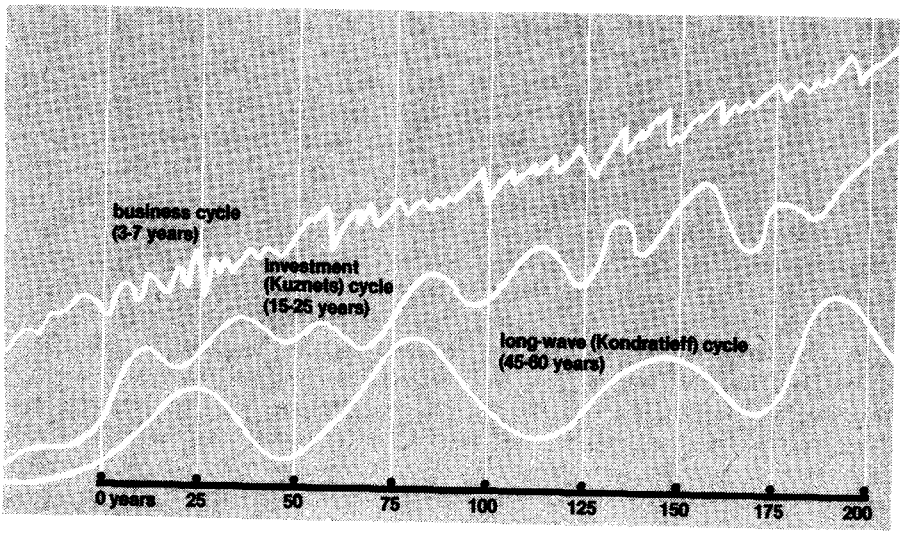
or two. What they have done (they think) is put their collective finger on the driving force behind the long wave: technology.

To see what they mean, let's take another look at the 1920s. The nationwide railroad system had just been completed. It had been touted as a guarantee of perpetual prosperity, a way of quickly counteracting regional economic difficulties such as crop failures, a way of increasing trade, a way of knitting the nation into a single economic entity. It was all of that, but once it was complete it meant an end to a huge line of investment. It meant a contraction in general economic activity. The situation was only worsened by the fact that the railroads were not the only example of 1920s technology at its peak.

According to Forrester, the picture is similar now. The interstate highway and air transport systems are complete, and their lines of investment are saturated—it costs much less to maintain a system than it does to build it. In addition, communications, electronics, and other technologies appear to have peaked (at least for the time being) and investment in them—the R&D money—is slowing. The similarity has led Forrester and his coworkers to say that a long wave is shaped by technology, that the wave swells to its peak as investment opportunities open up with the application of a new technology to replace the old and falls off into its trough when the investment opportunities are exhausted. A new long wave begins only when the physical capital built up during the previous one is used up and must be replaced. The length of a long



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wave therefore depends on how far ahead people plan, on how long they remember past depressions, and on a few other factors. It is no surprise that a long wave lasts, from depression to depression, about the span of a person's working life, or that a depression—the time from one peak to the beginning of the approach to the next—lasts about 20 years. These two times are the length of an economic memory and the life of a factory, respectively.

Is a depression just around the corner? It's hard to say. The time is right according to cycle theory, but technology is changing rapidly, so rapidly in fact that many people find it hard to keep up. At the same time, the economy's load of debt is large and investment is lessening. On the other hand, prices, wages, and profits are not falling except, perhaps, in real terms, but that's inflation for you. If we do have a depression, it could be accompanied by inflation to such an extent that the depression will be invisible, at least on the surface. If we don't have one, it will be because the availability of new technologies has kept investment at a safely high level.

In neither case will blame or credit accrue to our government, whose economic policies are notably ineffective. This will change, however, if Forrester's group succeeds in its study of the long wave. They would like to find ways to manipulate it; if they do, the government will surely incorporate their findings into official policy and use them to steer clear of depressions. (I do not trust the government to be satisfied with merely flattening the wave; it will be more likely to try to keep it humming along at the peak.)

Without successful intervention in the long wave, and with a depression, we are faced with two questions: How long will it be before the economy begins its climb to a new peak? and what will the technology be that stimulates that climb? The answer to the first, as I have already indicated, is "twenty years, more or less." As for the second, Forrester says he doesn't know the answer, though he does suggest that the next climb may be marked more by social change than by technological change.

To my mind, Forrester is ingenuous to claim ignorance. We can point to at least one thing that suggests what the new technology is likely to be. This is the fact that the technology that marks a long wave seems to have its roots in the previous long wave. The railroads began their development in this country in 1829, before the depression of the 1830s, when the line between Carbondale and Honesdale (both in Pennsylvania) was opened. It took two full long waves for them to reach their peak. The airplane and the automobile, associated with the present peak, first appeared in 1903 (the Wright brothers) and 1887 (the first Daimler). They too grew through more than a single long wave.

This pattern of initial development during one long wave and full flowering in a later one may be something we can expect to see in the technology of

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the next wave. After all, the basis of an economy cannot spring full-blown and immediate from some genius' brow. The groundwork must be done, the foundations laid. The question therefore becomes which of the various technologies we can see around us do we see only in embryo? Which ones still have their full flowering before them, yet still within the foreseeable future?

Communications and electronics? Maybe, but they are already so far beyond the embryo stage that I doubt they will define the economy of the next long wave except in an auxiliary way. Computers? More likely, but this technology too is beyond the embryo stage, even though it clearly has an immense amount of progress before it. Fusion power? That isn't even in embryo yet. Alternative energy resources? Probably not, even though their use will require a great deal of capital investment; they will not be necessary until most fossil fuels and uranium supplies are gone, which may not be until after the coming long wave; further, our need for energy may be met by fusion or solar power satellites before current energy sources are completely exhausted.

Each of the above is a possibility, but for one reason or another I prefer to set them aside in favor of the one technology which I feel probably will fuel the next economic boom. This is space technology—rockets, space shuttles, satellites, explorations, colonies, and with all this a corresponding

in times to come

● Next month we begin a new serial by William E. Cochrane, with a cover by Dean Ellis and interiors by Broeck Steadman. The title, CLASS SIX CLIMB, will be familiar to any mountaineers among our readers, but in the future Cochrane depicts, the classifications of climbs have been redefined a bit. And the object of this climb is not a mountain, but a tree the size of one—the Giant Tree of Kyle Murre—on a world set aside as a preserve and now threatened by outside forces. The final confrontation takes place on the Tree itself—and on the Tree's own terms.

Larry Niven and Steve Barnes have collaborated on THE LOCUSTS, a novella about a colony far from home—with a strange, sad, utterly unanticipated problem. R. C. W. Ettinger's fact article, A MATTER OF LIFE AND DEATH, deals with some of the potentials of cryonics, a familiar theme to science fiction readers which, like many such themes, is now close to reality.

We'll also have Jerry Pournelle's first ALTERNATE VIEW column, a thought-provoking piece called THE FAILURE OF NERVE, and as many short stories as space permits.

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degree of sophistication in communications, electronics, and computers. The seeds of this technology date back to Goddard's first rocketry experiments in the 1920s. As with the railroads, its development is taking more than one long wave. At present, it is poised on the brink of its flowering—the Space Shuttle is nearly operational, communications, weather, spy, and other satellites festoon our skies; men have been on the Moon; our machines have visited distant planets; and the blueprints have been drawn for solar power satellites and space colonies. The next step is the movement of industry, science, and people into space, the full exploitation of the new technology, and an enormous capital investment beside which the billions already spent on space will seem as nothing. Once this next step begins, the economic pressures it will produce should be more than enough to generate economic boom.

The problem is that although the technology is now poised for takeoff, it is likely to remain in that posture for some time. There is a depression due, according to the signs economists swear by, and during a depression no nation invests money in large projects, whether interstate highways or space colonies. When the depression is over, however, when buildings and machines have deteriorated to the point where they *must* be replaced if the economy is to function at all, investment picks up again and the economy begins to prosper. This time around we can expect to see some of the replacement factories built in space, new production processes designed around weightlessness or vacuum, and new schools, hospitals, and offices built for colonies in space or on other worlds.

How long will we have to wait for this science fiction dream to begin coming true? You know the answer. It's the title to this article; twenty years, more or less, while the economy bottoms out and present buildings and machines age. Twenty years, a time characteristic only of the long wave of economics and not at all of our wishes. Space is at hand, we tell each other, and it almost is. We have the techniques, the machines, the science to move out there tomorrow. We do not, however, have the economic motivation, and we will not until after the coming depression.

While we wait, it may be soothing to reflect that twenty years from now will put the opening of the true Space Age just about at the turn of the millennium. A new millennium, a new age of civilization, a new economic long wave—they go together well, don't they? The future we dream of is not quite at hand. But we do know when to expect it. ■

Reading

Jay W. Forrester, "Changing economic patterns," *Technology Review*, Aug.-Sept. 1978, pp. 47-53.

Nathaniel J. Mass, "Modeling cycles in the national economy," "*Technology Review*, March-April 1976, pp. 43-52.

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STATE OF THE ART

science fiction and 'literature' or the conscience of the king

Samuel R. Delany

At Oxford in 1892 the French poet Mallarmé delivered a lecture that began with the now famous line, "On à touché au vers."—someone has been tampering with poetry. Today, eighty-odd years later, I had thought of beginning, "Someone has been tampering with science fiction." But if I did, I would have to make some distinctions between 1892 and 1979 right off. For one thing, in 1892 the person who was doing (by far!) the most tampering was Mallarmé himself—along with a few poets who were comparatively closely associated with him (they came for coffee every Tuesday evening).

The tampering I'm talking of is not coming from within science fiction. When I read writers who are just my juniors, in length of time published if not in years (John Varley, James Tiptree Jr., Michael Bishop, Vonda McIntyre, Jean Mark Gawron, Suzy McGee Charnas, or Joseph Haldeman, to name the most random few), though of course I see local disagreements, a whole variety of different approaches to the world between them and me, between each of them and each other, I don't sense any violent rupture between these newer writers and those writers who are my immediate contemporaries (Disch, Le Guin, Niven, Russ, Zelazny, to name another random few). Also: though most of us within the genre no doubt feel the Old Wave/New Wave controversy of

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a decade or so ago is far too frequently exhumed, there's at least one point about it that is all too seldom made, and might well vanish if someone doesn't record it. There were obviously a variety of local differences. But even the term New Wave, which was applied to me often enough, gained its currency mainly in the mouths of a number of writers who apparently took a great deal of pleasure standing up on platforms and saying, "Well, I guess I'm an Old Wave writer." I can honestly say I never once seriously referred to myself as a "New Wave writer" and the number of times I did jokingly could be counted on one hand—and I think the same would probably go for the other writers who, from time to time, got lumbered with that very silly term. Consider: the writer whom I personally heard say, more times from more platforms, "Well I guess I'm an Old Wave writer," was Frederik Pohl, who was back then my most supportive of editors at the now defunct magazines *If* and *Worlds of Tomorrow*. Today he is my most supportive of editors at Bantam Books. Does this allow for differences? Yes. But it doesn't speak of rupture.

The tampering I'm talking about does produce a sense of rupture. Though there is much disagreement among writers of all generations whether this rupture is a good or a bad thing, we all sense it. It is the tampering that comes from academia, from critics who have become "interested" in science fiction.

Now Mallarmé came from Paris to Oxford to defend his own tampering and that of his fellow poets. I have barely recovered from a term as research-fellow at the Center for Twentieth Century Studies at the University of Wisconsin (research topic: contemporary science fiction) and have limped back to the fold here . . . to *defend* academic tampering!

"*On à touché au vers?*" Well, to paraphrase the Yale critic Paul de Man, "*On à touché au critique.*" People have also been tampering with academic criticism recently. Myself, I've been tampering with science fiction criticism for all I'm worth. (You can find the results to this tampering in two new critical books by me: *The Jewel-Hinged Jaw*, a collection of essays, New York: Berkley-Windhover Books, 1978, in paperback, and *The American Shore: meditations on a tale of science fiction by Thomas M. Disch—Angouleme*, from Elizabethtown, New York, Dragon Press, 1978.) But the only way to launch a good defense of anything is first to separate out what's definitely bad: when something doesn't work and leads nowhere, covering it up doesn't do anyone any good. We have to locate why this tampering is experienced as rupture and as encounter—and I don't mean from simple prejudicial xenophobia. Having had a chance to teach science fiction at two universities in the last few years, as well as a chance to write my share of academic criticism and survey the present academic response to science fiction, I'm in a

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particularly good position to experience the rupture aspect—and, yes, it *is* an experience!

In 1975, when I was organizing a scholarly symposium on science fiction at the University of Buffalo, SUNY, I was extremely excited to have in attendance an exemplary Joyce scholar and literary theoretician who was about to publish a book on science fiction with a polysyllabic title from a highly respected university press. The day the symposium began, advance copies of the book arrived. I made a breakfast appointment with this very affable gentleman to discuss his book with him the next day—and stayed up till four o'clock in the morning reading over the book twice and filling the margins with notes and comments. Over scrambled eggs and toast, I gave him my notes: they ranged from proofreading errors, to correcting dates to respectful deferments on matters of opinion. But at one point, I referred to something he had to say about the use of matter transmission in science fiction, using Niven's *Ringworld* for his example. His idea had to do with "matter transmission" as a metaphor for telekinesis, and what he felt telekinesis meant to people. "I'm just curious," I said, "why, if you wanted to make a point about telekinesis, you didn't refer, say, to Alfred Bester's *The Stars My Destination*, where the idea is dealt with directly, and in very much the manner that you outline. Do you think, perhaps, the book has received too much attention? Or perhaps it's not as good as people are always going on as if it were?"

And this gentleman, who had been writing so eloquently about Le Guin's themes and Sturgeon's prose, looked at me with perfect ingenuousness and asked: "Bester? *The Stars My Destination*? Is this a book or an author I should have heard of before?"

This is totally disorienting; it throws the whole discussion onto a level of surrealism that is mind-boggling. Someone who writes a book on a subject, about whom you can say "They don't know the field," is usually someone who gets dates wrong, forgets small facts, comes to wrong-headed opinions. Perhaps there are a number of important works that they haven't read recently enough or closely enough and therefore are relying too heavily on what another writer had to say about them. But can you imagine asking someone who has just written a book on twentieth century poetry why they didn't mention T. S. Eliot or *The Waste Land*, only to get the perfectly serious answer: "T. S. Eliot? *The Waste Land*? Is this a poem or a poet I should have heard of before?"

This is rupture.

The particular critic, I'm happy to report, over the next two years did a lot of homework and wrote a much better book with a much less polysyllabic title—published by a different university press.

But the experience of rupture remains.

Then there was the academic critic who, from his chapter on science

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fiction in his book on fantasy, had apparently discovered Michael Moorcock's delightful *War Lord of the Air*, and decided that Mr. Moorcock had, out of sheer original genius, invented an entirely new subgenre of science fiction, which he dubbed, "the historical alternative story." He went on to say that though he suspected there would be a lot of argument among regular SF fans about whether or not Moorcock's brand new SF twist would be accepted or not, he felt this new form really should be included in the overall genre of science fiction—just as if Dick's *The Man in the High Castle* had never been written, nor won its much deserved Hugo award for best novel of its year, not to mention his complete ignorance of all the other parallel-world stories (historical alternative indeed!) from Ward Moore's *Bring the Jubalee*, to Hilary Bayley's "The Fall of Frenchie Steiner," and Joanna Russ's *The Female Man*! This same academic, comparing the reader response to two novels published in 1953—Sturgeon's *More Than Human* and Clarke's *Childhood's End*—while noting that though both books were good he felt Sturgeon's was the better, then went on to locate internal reasons in both novels as to why the Clarke had outsold the Sturgeon! Does anyone remember that about ten years ago there was a very successful movie called *2001: A Space Odyssey*, which catapulted Clarke into a multimillion dollar ad campaign, from which time the numerous reprints of his books by and large date. If you compare the first fourteen years of life of both books, you find that both were reprinted six times; and from people who were then at Ballantine Books, the publisher of both novels, the Sturgeon marginally outsold the Clarke! So much for internal reasons!

Perhaps the most awkward ignorance I've encountered in an academic, concerned with what academics themselves have done in science fiction: on the organizing end of another SF symposium, I recently received an abstract of a paper to be presented that opened with the blanket statement that nobody ever took SF seriously before 1973! The first time I was ever invited to address the Modern Language Association on science fiction was in 1967. But the Continuing Seminar on Science Fiction of the Modern Language Association was founded in 1951—indeed it is the second oldest continuing seminar in that august organization that includes thousands of college professors!

I experience all of these as rupture. They represent simple ignorance. They are bad academic criticism. The healthiest response I can think of to start with is a good, hearty laugh. But we can't stop with laughter, because there is so much ignorance. One of the things that laughter allows us to do is get back far enough to see that there *is* a pattern to it: the rupture we experience—that I experience—is not a rupture that comes from the critics' abuse of specific texts. After all, I've been reading SF book reviews in the maga-

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zines for going on twenty-five years, and I've certainly developed enough callouses to cracked-brain appraisals of individual books by now.

The rupture I experience is a rupture with my own knowledge of the historical reality of science fiction writing. The working assumption of most academic critics, an assumption which certainly distorts what they have to say of specific texts, is that somehow the history of science fiction began precisely at the moment they began to read it—or, as frequently, in the nebulous yesterday of sixteenth and seventeenth century utopias. For both accomplish the same thing: they obviate the real lives, the real development, and finally the real production, of real science fiction writers, a goodly number of whom are still alive if not kicking. This is why the best histories of science fiction remain the commentaries of Merril and Asimov in their various anthologies, the collected reviews of Knight *In Search of Wonder*, Blish *The Issue at Hand, More Issues at Hand*, and the Panshin's *S-F in Dimension*; for the rest one must go digging through the back reviews of Merril, Budrys, del Rey, and Miller. Frequently wrong, frequently brilliant, wrong or right they were responding *to* what was happening in the field; and their criticism, in conjunction with the texts, is the only way to *find* what was happening, whether as ambiance or as dates and occurrences. And this is equally why something like Aldiss's *Billion Year Spree*, entertaining as parts of it are, is basically useless as a history of SF—for it covers desultory writing from Mary Shelley's *Frankenstein* to the first use of the term "science fiction" in 1929, and then careens through all that legitimately bears the science fiction label itself in a handful of pages that, once it passes the Second World War, becomes mere listing.

Then what do we do with this debacle of historical ignorance; what do we do with the rupture?

I'll start by telling you the very first time I sensed it: because, oddly, back then it did *not* come from an academic. It came from directly within the genre precincts. In 1966 I attended my first World Science Fiction Convention, the Tri-Con (with a then record attendance of six thousand) held over Labor Day weekend in Cleveland. All the talk among the professional writers that year was of one New York editor at a major publishing house who had just upped his company's output of hardcover science fiction from two novels a year (which it had been for the last ten years) to twenty-four (!) novels a year (which, incidentally, it has been for the last twelve years). All we pros, young and old, talked of this man in reverent tones, as a great gentleman, practically a scholar, who was seriously committed to the field and deeply concerned with the development of the genre. That weekend, Roger Zelazny's novel *This Immortal* tied with Frank Herbert's *Dune* for the Hugo Award—indeed, that weekend was the first time I met Zelazny in person.

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(Back then, because our names shared five letters, we were frequently mistaken for one another by readers.) Over dinner with Roger and his wife in the hotel's rather ornate restaurant—it had a transparent plastic bridge over a luminous fishpond—he mentioned that *This Immortal* had, months ago, been submitted to this fabled editor, who'd bounced it. Well, certainly there was nothing too remarkable there. But back in New York, a week later, the will of the gods conspired so that this very editor called me up and invited *me* to lunch! And that is how it came to pass, when there was a lull in the conversation, after the first very dry martini and before the fillet of sole, I casually remarked: "I was just in Cleveland last week, and Zelazny's *This Immortal* tied with *Dune* for the Hugo. You may have missed out on something there; Zelazny tells me he submitted it to you and you bounced it."

And the great man, shining hope of the genre, committed to and concerned with the development of the field, looked at me across the rim of his martini glass and, with a slight frown, inquired: "The Hugo Award? Now what is that?"

This was my very first encounter with that complete surreal dissociation with what I had taken to be the real world: the science fiction editor of a major publishing house, who himself edited twenty-four science fiction novels a year, in 1966 did not know what the Hugo Award was! It was precisely this feeling that returned, only a few years later, when I began to encounter what, with only a little over-politeness, we might call "certain academic blind spots."

The point, of course, is that such rupture as we experience it at the hands of academics is not new. We've experienced it before in the hands of editors and publishers who really *do* have their hands on our economic jugular veins. And we've survived it—survived it very well. In 1951 (the year of the establishment of the MLA Continuing Seminar) there were some fifteen texts published that could reasonably be called science fiction novels—including the serials in magazines and the first volume of the "Foundation" series, which was really a compilation of stories written since 1942. Last year over fourteen percent of *all* original fiction published in the United States was science fiction. (That's just shy of 500 books.) And so my anecdote about my 1966 editor is finally just curve-fixing to show how sharply the slope has been rising. No, the imposition of a rupture with our own history is not new to us. Let's keep a clear expression on our faces and go on to look, dispassionately, at what is happening.

Now you simply can *not* break off one history from a phenomenon without replacing it with another—even if you replace it with nothing more than the equally historical assumption that the phenomenon you have just stripped of its past *has* no significant history. We've talked a lot about rupture and only in passing about encoun-

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ter. The encounter, of course, is between the new history that has been stuck on the original phenomenon and the phenomenon itself—in this case science fiction. Now here's a little leap for you. But follow it carefully, because it tells a lot about where we're shortly going to go. To say that a phenomenon has *no* significant history at all is a very sneaky way of allowing yourself to treat it as *if* its history were exactly the same as some other phenomenon you are already acquainted with. I don't mean this in terms of dates and occurrences, but rather in terms of values, processes, ways of understanding it and responding to it. To say that a phenomenon *does* have a significant history is to say that its history is different from the history of something else—that's what makes it significant. To assume that something—like science fiction—has no *significant* history in the past is to assume that its history-to-come will be no different from the last phenomenon whose history you've been studying. (Again, I don't mean in terms of dates and happenings, but in terms of values and responses to ways the phenomenon can be meaningful.) And the historical phenomenon most literary critics have been studying hardest is, of course, literature.

After we have passed the sense of rupture, here is where we locate the sense of encounter. And it's the growing number of feet of shelf space in bookstores, the growing number of readers who turn to science fiction, the growing number of reading hours that readers are devoting to science fiction, and the growing number of courses given on science fiction in the country's high schools and universities (over five hundred at last count) that give this encounter all the urgency of a battle.

What we have to remember, before all our images of growing amounts of shelf space, growing numbers of readers, all with their economic implications and insinuations, is that the battle is not between texts.

If I hold a copy, say, of Clement's *Mission of Gravity* in one hand and Salinger's *Catcher in the Rye* in the other, there's no encounter. Even if I read one right after the other, there still is no real encounter between the stories themselves. The encounter comes after both texts are read, in the whole space of values, of judgments, of ways of response: which responses (and reading itself is basically a *response* to a text) are more pleasurable, which are more useful; and it's only when we reach the question, "Which are more available?" that the whole economic situation which lurks behind our initial set of images for this encounter intrudes on and effects this encounter—rather than being (according to the capitalist ideal anyway) simply an economic response to the encounter itself.

So: for the purposes of the rest of this essay, we must think of literature and science fiction both not as sets of labeled texts, but as two different sets of values, two different ways of response, two different ways of making

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texts make sense, two different ways of reading, or what one academic tradition would call two different discourses (and the meaning of *discourse* here is not simply explanation, but rather a range of understanding that involves certain characteristic utterances: the larger process that allows explanations to be and of which they are a part). The encounter, then, is between two discourses, science fiction and literature: and it is won or lost in terms of pleasure and use. The encounter could be hugely influenced by economic availability; but since availability of both discourses seems assured (the one—literature—large; and the other—science fiction—growing), we can discount that for the present.

A number of times I have written extensively about the way the discourse (the way of understanding, the way of responding, the way of reading) called science fiction differs from the discourse called literature, particularly that bulk of literature which we science fiction readers call mundane fiction (from *mundus*, meaning the world: stories that take place on the Earth in the present or past. Any other connotations? Well, we figure turnabout is fair play). There are clear and sharp differences right down to the way we read individual sentences: "Then her world exploded." If such a string of words appeared in a mundane fiction text, more than likely we would respond to it as an emotionally muzzy metaphor about the inner aspects of some incident in a female character's life. In a science fiction text, however, we must retain the margin to read these words as meaning that a planet, belonging to some woman, blew up. "He turned on his left side." The discourse of mundane fiction more or less constrains us to read such a string of words as referring to some kind of masculine, insomniac tossings. Science fiction discourse retains the greater margin to read such words as meaning some man reached down and threw a switch activating the circuitry of his sinistral flank.

And there are many other sentences with a perfectly clear and literal meaning in science fiction that, if they were written within the discourse of mundane fiction (e.g., Heinlein's "The door dilated" from *Beyond This Horizon*) would simply be meaningless or, at best, extremely awkward. Consider: there is no sentence I can think of that theoretically could appear in a text of mundane fiction that could not also be worked into some text of science fiction—whereas, there are many, many sentences in science fiction that would be hard or impossible to work into a text of mundane fiction. Science fiction discourse gives many sentences clear and literal meanings, that in mundane fiction would be meaningless, or at any rate very muzzily metaphorical. Just at the level of lucid and literal sentence, then, which is the larger way of response, the wider range of understanding? Which offers the greater range of readings for possible sentences?

More recently I have been explor-

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ing the way we actually organize the information from science fiction texts—exploring the organization principles of science fiction discourse. Because in the discourse of mundane fiction the world is a given, we use each sentence in a mundane fiction text as part of a sort of hunt-and-peck game: alright, what part of the real world must I summon up in imagination to pay attention to (and, equally, what other parts—especially as sentences build up—had I best not pay attention to at all) if I want this story to hang together? In science fiction, the world of the story is not a given, but rather a construct that changes from story to story. To read a science fiction text, we have to indulge a much more fluid and speculative kind of survey. With each sentence we have to ask what in the world of the tale would have to be different from our world in order for such a sentence to be uttered—and thus, as the sentences build up, we build up a world in specific dialogue with our present conception of the real world.

Again, to take a string of words that, alone, might lend itself to either discourse, here is a sentence from Pohl and Kornbluth's *The Space Merchants*. "I rubbed depilitory soap over my face and rinsed it with the trickle from the fresh water tap."

If this were mundane fiction, because the world in mundane fiction is a given world, we would read the adjective "fresh" (since, in the real world, the vast majority of water faucets are indeed fresh water faucets) as either an unnecessary writerly redundancy (and therefore an auctorial failing) or some comment on the consciousness of the character: perhaps he is abnormally aware of the water's freshness for some, subjective reason. Similarly, the trickle we would read either as support for, or contrast with, this particular subjective state. But while hints of this reading are, of course there, in the science fiction text where it actually occurs this sentence is telling us much, much more: in the world of *The Space Merchants*, because of the overpopulation, apartments have both fresh water *and* salt-water taps—and the second half of this sentence is one of the more important phrases from which we learn this. The trickle tells us specifically that the fresh water supply in this particular building is low, even though it's a luxury apartment complex. Yes, states of mind are suggested about the character by this sentence in context; but in science fiction discourse we must retain the margin to take such information and build a world specifically different from, and in dialogue with, our own.

During my terms teaching science fiction at Milwaukee and Buffalo, I encountered my share of people, students and teachers, who simply wouldn't read science fiction. But I encountered a much more interesting group of people who honestly *couldn't* read science fiction—or at least not with any pleasure or understanding. With a number of these people, I actually sat down and read some science

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fiction stories with them, sentence by sentence, the way you would with a five-year-old just learning to read. The difficulty was almost entirely at this level. Unless the nature of the world of the story was completely spelled out for them in solid, expository paragraphs, they simply couldn't take the hints, the suggestions, the little throwaways with which the inventive science fiction writers get this dialogue going in those readers comfortable with the discourse; they couldn't make them into any kind of vision of a different world. But then, where would they have had the opportunity to learn? Certainly not in contemporary mundane fiction. And, yes, with practice, most of them got a *lot* better at it.

I, myself, find science fiction's literalisation of the language, its wealth of clear and lucid sentences, simply and sensually pleasurable. I find the dialogue it sets up with the real world (a dialogue that mundane fiction simply cannot indulge) both pleasurable and useful—if only because it keeps the possibility of dialogue alive. But if we really want to explore the encounter between values that, finally, *is* the encounter between literature and science fiction, we have to go into the values of literature as well.

The French scholar Michel Foucault is one of the most radical and fascinating thinkers to tackle this problem. In an essay called "What Is an Author" he notes that many of the values of literary discourse are tied up in the very concept of the "author" of a work. The author, or, as he sometimes calls it, the "author-function" becomes the focus for some of literature's most central values. In this essay he writes:

It seems . . . that the manner in which literary criticism once defined the author—or rather constructed the author, beginning with existing texts and discourses—is directly derived from the manner in which Christian tradition authenticated (or rejected) the [religious] texts at is disposal. In order to "rediscover" an author in a work, modern literary criticism uses ways similar to those that Christian religious commentary employed when trying to prove the values of a text by its author's saintliness. In De Viribus illustribus, *Saint Jerome explains that bearing the same name is not sufficient to identify legitimately authors of more than one work: different individuals could have had the same name, or one man could have, illegitimately, borrowed another's patronymic [family name]. . . . How then can one attribute several discourses to one and the same author? How can one use the author-function to determine if one is dealing with one or several individuals? Saint Jerome proposes four criteria: 1) if among several books attributed to an author one is inferior to the others, it must be withdrawn from the list of the author's works (the author is therefore defined as a unified level of value); 2) the same should be done if certain texts contradict the doctrine ex-*

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pounded in the author's other works (the author is then defined as a field of conceptual or theoretical unity); 3) one must also exclude works that are written in a different style, containing words and expressions not ordinarily found in the writer's production (the author is here conceived of as a stylistic unity); 4) finally, one must consider as interpolated those texts which quote people or mention events subsequent to the author's death (the author is here seen as a historical unity and the crossroads of a limited number of events).

Modern literary criticism, even when—as is now customary—it does not concern itself with authentification, still defines the author no differently . . . (using the author's biography, the determination of his individual perspective, the analysis of his social position, and the revelation of his basic design): the author is . . . the principle of a certain unity of writing—all differences having to be resolved, at least in part, by the principles of evolution, maturation, or influence.

This is from a revised version of the lecture, *What Is an Author*, given in 1969 at the *Société Francaise de Philosophie*, which will soon appear in an anthology edited by Joseph Riddel. I have very modestly revised the translation at a few points. The unrevised version of this lecture may be found in *Language, Counter-Memory, Practice*, by Michel Foucault, edited by Donald F. Bouchard, Ithaca, New York, Cornell University Press, 1977.

Clustered around the literary concept of "author" then, we find this quartet of literary values: unity of value, theoretical unity, stylistic unity, historical unity. It is a little sobering to consider that a discipline like literary criticism grew so directly out of a dogmatic religious enterprise. But these values are certainly among its controlling parameters. One of the last major battles in the history of the English novel was the furor over whether or not D. H. Lawrence was to be accepted as a Great Author, or consigned to the category of interesting crackpot. The critic R. F. Leavis, in his book on Lawrence that pretty much settled the question (*D. H. Lawrence: Novelist*), goes out to prove Lawrence's greatness, right in chapter one, by showing the "unity" of Lawrence's works.

And I have seen at least one master's thesis written about my own science fiction that set out to prove me an author worthy of serious consideration—by demonstrating the unity in none other than the works of Samuel R. Delany!

At this point we have to ask: Are these unities part of science fiction discourse? Should they be applied to science fiction?

I've already talked about the way, sentence by sentence, science fiction can differ from mundane fiction. I've talked as well about the way science fiction organizes this sentential infor-

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mation—not only into a story but also into a world—that is different from the way mundane fiction organizes its information. I also feel that if we look for this quartet of literary unities—valuative, theoretical, stylistic, and historical—in science fiction discourse, whether clustered around the author or not, we will find absolutely diametric values.

Working backwards through them: One must consider as unauthentic "those texts that quote people or mention events subsequent to the author's death." Well, that certainly lets science fiction out of the historical-unity game! Science fiction's very commitment to its future vision means that the SF writer is always quoting people and mentioning events subsequent to the writer's death! So this basic image of historical unity is denied at the outset. But it's not the image we are concerned with so much as the value as an operative function: and the historical value science fiction seems to operate by, more than any other, is one of historical plurality—a value diametric to the unitary value of literature. This is reflected not only in the diverging historical views within the production of a single writer (nothing stops me from writing three science fiction stories, all set in New York City in Twenty-One-Hundred, one in an overpopulated world, one in a depopulated world, and one in a world whose population has managed to stabilize at, say, two and a half billion: they would simply involve three different extrapolations), but also the parallel universe tales that so astonished the academic about whom I wrote earlier.

This is possibly the place to point out that the author, or author-function, simply plays a very different role in science fiction discourse from the one it plays in the discourse of literature. I doubt I have ever called myself a "science fiction author"; the term would simply feel too uncomfortable in my mouth. When someone asks me my profession, I say I'm a science fiction writer. Again, I think the same goes for most other writers in the field. By and large readers tend to be much more concerned with stories than with writers. But this leads us to the next value.

The value of unity of style: science fiction's origins in the pulps and persistence as a generally popular literature simply mitigates against the sort of stylistic unity that literary value demands, both in the productions of single writers and, certainly, in the production of the whole field. Writers are always adopting different styles for different stories, and evolution, maturation, or even influence are just not the operative factor—the stories, or even the particular level of the readers, demand them. For a good long while now science fiction has been responding to readers on all levels: someone who loves the simplistic thrust of a Perry Rodan book is probably not going to love the techno-social recomplications of a John Varley or the logico-linguistic invention of a Jean Mark Gawron—though I know

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of at least one mathematics professor who reads all three avidly. The point, however, is that all three are science fiction. But because of the range of markets, the range of readers, there is simply very little chance of stylistic unity as we find it in the literary concept of author-function. Again, if anything, there seems to be a highly valued ideal of stylistic plurality—especially since the science fiction of the sixties.

Well what about theoretical unity? The other side of science fiction's commitment to historical plurality is an equal commitment to theoretical plurality. What has most confounded the folks searching for definitions of science fiction in terms of scientific subject matter is the number of science fiction stories that clearly contradict known science—take all the stories with faster-than-light travel, for example. Then, of course, there are all the undeniably science fiction stories about magic (e.g., Gogswell's "Wall Around the World," Blish's *Black Easter*). To say, well, in these tales magic is treated in a "scientific way" only blurs the question: currently the existence of magic runs counter to scientific theory, and that's all there is to it. Then there are all the stories about ESP, which, if not exactly contradicted by prevailing theory, are certainly rendered highly dubious by it. Mumbling about "exceptions that prove the rule," whatever that means, simply doesn't cover the case. The concept of theoretical plurality, as an operative value, does. For there to be such a value, the genre, across its range, *must* deal with conflicting theories. This value does not necessarily fix itself to the "author" function in science fiction: not every writer feels the necessity to choose opposing theoretical constructs from tale to tale—though many have. I would hazard, however, that every science fiction writer, precisely to the point that her/his own work is theoretically consistent with itself, is very clearly aware of one or more science fiction writers with whom that theory conflicts, whether the theory be political, sociological, or scientific. And there's your value of theoretical plurality.

Finally there is unity of value itself. As history and theory, whether unitary or plural, form two sides of a single coin, so style and value, whether unitary or plural, form two sides of another (and here, of course, style means a little more than merely use of words; there are styles of thinking, styles of perception). The same factors that assure SF will not exhibit any unity of style in the literary sense, but rather a plurality of styles, both within the production of single writers as well as throughout the generic range, also means that science fiction actively strives for a plurality of value (i.e., worth). Once a text is adjudged "literature," we can say it partakes of a certain (admittedly vague and almost impossible to define) value, a value that, however vague, consists of a juxtaposition of theoretical, stylistic, and historical elements. This value—the text's literary value—militates for

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the text's preservation, its study, its reproduction. But once more, this is *not* the case with science fiction. Having adjudged a text science fiction, we simply have made no unitary statement, however vague or at whatever level of suggestion or implication, about its value. Again, I suspect this is because innate to the discourse of science fiction is the concept of a value plurality.

It may be well to point out here exactly what we have done—so that no one is tempted to overvalue *our* exploration. We have simply taken the list of values Foucault has recovered under the literary concept of "author" and let them guide us through the range of science fiction—whereupon we found some values that pretty much oppose the literary ones. We have not necessarily discovered the *most* important values of science fiction. *They* may lie completely elsewhere. The ones we've found only take their particular highlighting when held up against the literary.

So: do I feel that science fiction will, or should, be taken over by literature in the current encounter? I sincerely hope it is not. And the only way I feel it can be taken over is for very bad academic criticism—the kind that strips science fiction of its history, that ignores it as a discourse, as a particular way of reading and responding to texts, and that obscures its values of historical, theoretical, stylistic, and valuative plurality—to swamp what I feel is a responsible academic approach, of which I offer my own argument up till now as a modest example.

This brings us to what may well be the most important battlefield in the encounter. Around every text there is a space for interpretation. There is no way to abolish the interpretive space from around the text: it comes into existence as soon as we recognize the words' meanings. Most of us who have a strong sense of that space have it through the interpretive use it has been put to in literary criticsm.

Take a sentence from a very entertaining book by the poet John Ciardi, *How Does a Poem Mean,* "A poem is a machine for making choices." Does this mean a poem is a machine to decide between A and B? Or does it mean a poem is a machine for generating situations in which some choice is involved? In other words: is *making choices* to be taken idiomatically "Make a choice: choose A or B," or literally "Make—that is, create—a choice situation." Having unpacked these two possible meanings from our text, there are several possible ways to relate them, and which one we choose depends on whether our basic discursive values are unitary or plural.

I can say: Let it mean either *one* that you want; choose which *one* you prefer. (Liberal as it is, it's still unitary.)

Or I can say: Now logically, you can't decide between A and B *until* you've generated the choice situation. Therefore, it must mean generate a choice situation first and then make it. (Here, we've made a logical hierarchy

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out of the two meanings, which is tantamount to reducing it to a continuous, single argument. We're still unitary here.)

If I'm feeling very inventive I can say: First one must choose whether or not to interpret the text, and only after one has made this choice is there the possibility of the text generating a choice situation, so that it must mean first choose, and then generate. (I've just reversed the hierarchy, but it's still unitary).

And the other thing I can say is: To read the sentence "A poem is a machine for making choices," we have to read it first one way *or* the other. But the moment we have, the suggestion of the other meaning rises up to obliterate the former in our minds, and the meaning plays back and forth between the two, so that the joy, the wit, the delight of the text comes from that play between *both* meanings, which keeps it from totalizing into any hierarchical form.

Here we have pretty clearly gone with plural values, in an attempt to capture something of the experience of reading the line in the first place—the same experience that got us started off on our various unitary interpretations.

Locating the play in the interpretive space (rather than a unitary, or hierarchical explanation) is something that some of the most intriguing academics have been working with. Some names? Jacques Derrida, Shoshana Felman, Paul de Man. It can be done in a number of ways: In the song from Shakespeare's play *Cymbeline*, we find the lines:

Golden lads and girls all must
As chimney sweepers come to dust.

It seems a pretty clear statement about the eventual death of (or the necessity of work for) even the young and beautiful as well as the dirty and grubby. Some time in the thirties, a scholar traveling in Warwickshire, the county of Shakespeare's birth, discovered that the local slang for the flowers we call dandelions was "golden lads," and when the yellow fuzz was blown off the dandelions' heads, the same farmers called them "chimney sweepers." Apparently, these local terms are several hundred years old. Read the two lines again. They haven't *lost* any of their meaning. But a whole range of play has been introduced with the recovery of the local Warwickshire dialect. If one wants to be "literary" about things, one can hierarchise *all* the meanings into a logical unitary order to turn them into a single, coherent essay—indeed, as we have seen before, we can turn them into several different coherent essays and then (if you want) begin all over again, hierarchizing *them*. I would hazard that Shakespeare's delight in the line, as well as the delight of his audience, was in the simple play of plural meanings that we now have, knowing both literal and dialect interpretation of the terms.

What does this little diversion have to do with science fiction? Well when Roger Zelazny in *This Immortal*,

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writes of a biologist breeding poisonous fleas called slishi to kill off an invasion of spiderbats on the Monterey coast, "When the spiderbats return to Capistrano, the slishi will be waiting," he is basically initiating the same sort of play as Shakespeare. But to perceive the play, one must know that there was once an extremely sentimental old lyric, "When the Swallows Return to Capistrano." Zelazny's line puts that sentiment in play with the grim literalness, and the result is amusing, entertaining, and, though highly suggestive, does not really lend itself to a unitary, single interpretation. (If we may add play to play: it seems that the play's the thing . . .!)

Here's another way in which historical awareness can indicate the play in both a "literary" writer like Shakespeare and a science fiction writer like . . . Asimov! We know, for example, from historical research, that Shakespeare's plays were performed with elaborate costumes—and *no* scenery at all (if you don't believe me, check Asimov's two volume *Asimov's Guide to Shakespeare*). This is why the characters spend so much time describing where they are, in ways that, if a cowboy in your latest movie-western did it, "Well, here I am in this dark wood full of elms and sycamore, as the light dims and the pinecones cast long shadows over the dead leaves around my boots" would make the audience howl. To know this today allows us to read these parts of the dramas in a context that lets them do their jobs again; and it lets us respond to the many subtle ways in which descriptions of locations are worked in, rather like the little throw away bits that give you the world of a science fiction story, even in the midst of character interchanges. They no longer seem grey, awkward, and superfluous. We are no longer left giggling at best, or simply scratching our heads at worst. Myself, I think a good giggle may be the better way to start because, it *is* a response *to* the text. And the person who can't giggle at all is simply unresponsive to our current movie and theater conventions of realistic scenery; and that's a little less forgivable than not knowing Shakespeare's conventions. Moreover, without the giggle, you miss out on the historical play that time has overlaid in a very real way on Shakespeare's texts. Now where did Asimov go in all this? Well, here's a little bit of history that time and again I've found helpful in teaching people the "Foundation" stories. The first story in "Foundation" was written in 1951; it begins in a spaceport—most of the students at the class where I first taught the stories had come to the college by plane. One of the things I found helpful for students trying to visualize the story is this:

In 1951, air travel was much less a part of people's lives than today. There was *no* commercial jet travel. And Asimov had never ridden on a plane at this time, nor probably visited an airport more than a time or two at most. If you want to visualize Asimov's spaceport, don't start with your own experience of Kennedy, O'Hare,

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or L. A. International. Instead, just before you read the story, go back and visualize a major trainstation, Grand Central Station in New York City, or Victoria Station in London, or *Gare de l'oest* in Paris. Does this mean Asimov's spaceport *is* a trainstation? Of course not! But if you use a trainstation as your basic imaginative material, the whole thing will be vivider, things will seem to make more sense, and you will see more in your mind's eye when you read it. (And for what it's worth, well after I started using this little pedigogical prod, Dr. A. heard about it and complimented me on my insight.)

Notice that all this information, when written into the interpretive space around the text (whether it is Shakespeare's text, Asimov's, or Zelazny's), results in the text's becoming vivider. *More* things can go on in the text. The information is not used to constrain the text to a single, or unified meaning. Rather, in each case, it releases meanings which then come into the play of meanings that is the text. (Think of "play" not so much in terms of children's fun or adult competition, but in terms of a gear or a steering wheel that has play in its movement—though certainly all those other meanings represent points about which the play—in the word play—moves, as does the whole idea of theatrical play as well.) Notice this is *not* the same thing as saying, "The text can mean anything you want . . ." with its implication, "Choose whichever *one* you prefer," which gets us back to the unitary.

This seems to me to be, with both literary texts *and* science fiction texts, the proper use of the interpretive space that lies about them both. An awful lot of science fiction readers, however, confuse the existence of that interpretive space with the values the interpretations most often written into that space have, most often, supported: those literary values that are unitary and authoritarian. The response of these readers—frequently our older readers—no doubt impelled by the best of intentions (their wheedling suspicion of the inappropriateness of unitary values to a genre that is so clearly a pluralistic enterprise), is simply to deny the existence of the interpretive space about the science fiction text. The usual way of accomplishing this is for these readers to assume a conscientiously philistine approach—which is what they intuitively feel is opposed to a "literary" approach: "First of all," they say, "science fiction is merely entertainment." But can't you hear, lurking behind this statement, an appeal not to the notion of a plurality of values but to a single value—in this case "entertainment value"—which is there to totalize the whole field. This is simply the mirror image of the statement, "Literary texts have literary value," (the good ones presumably having more of it, the bad ones less, but all literary texts having some, by which they are adjudged literature in the first place); "Science fiction texts have entertainment value," (the good ones, again,

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having more, the bad ones, again, having little or trivial amounts). The values are different; but *both* are unitary.

Whenever I encounter that particular phrase, "science fiction is entertainment" I like to insert a little verbal play into the interpretive space around it: "entertain" has two meanings in English. One can entertain friends, an audience, oneself (this is called the active voice of the verb); but one can also entertain ideas—trivial or profound—notions—pleasant or sad—and fancies—pretty or ugly (in Greek this would be called the middle voice of the verb; and English has precious few verbs with both). If science fiction is "entertainment" in both senses, then its values must fall out of the play between them, no . . .?

But of course the significance of "science fiction is merely entertainment" is not just as a single pronouncement that ends there. It is part of a whole, philistine reader-view, and is associated with a whole galaxy of pronouncements. Anyone who has been around science fiction for any length of time will recognize that they all go together:

"I like a science fiction story that's told in good, simple language with none of your fancy writing or experimentation, with a nice, clear beginning, middle, and end."

But haven't we encountered, on the level of values, something very like this? Of course. It's nothing but an appeal for a unity of style.

"I like a science fiction story that sticks to good, hard science that we can all understand if we just know our general physics and chemistry."

But on the value level, we should recognize this one too: it's the call for theoretical unity, loud and clear.

"I guess I just wish they would write science fiction stories the way they did back in the 60's/50's/40's . . ." (You can choose your decade; there're adherents to all of them today.) You guessed it: it's the cry for historical unity.

Paradoxically, it is just this most philistine of reader reactions that, despite its good intuition, most strongly encourages the overthrow of science fiction by literature—because it writes in that space an interpretation of science fiction (and the philistine interpretation of science fiction is no *less* an interpretation of science fiction than the notion of science fiction with no significant history is a historical notion) that, through a process finally not too far from bad academic criticism, has very little awareness of the structure of science fiction discourse, either as a historically sensitive process (though the philistine may be aware of the history and able to spot the academic bloopers with the best) or as a present reality, in which each present writer is inserting her or his play into the plurality of values—valuistic, theoretical, stylistic, and historical—around which our SF discourse is organized. For we are not talking about complexity, or even quality, of interpretation, but rather about the values that a whole range of interpre-

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tations, good and bad, simple and complex, reinforce. And the philistine view is right there, with all its authoritarian vigor, at the center of the literary enterprise—even when it may well be the play of pluralities that the person expressing that view is actually responding to in any given science fiction text that delights.

What this essay has been on the verge of proposing, as some of you by now no doubt have suspected, is nothing less, in this encounter, than the takeover of literature by science fiction. This has been suggested (with varying degrees of play) by various writers at various times in the past. But it is just what gives the phenomenon its aspect of encounter that also, today, in a very real way makes that a possible outcome. Again, I must remind you, I do not mean an economically encouraged encounter between texts: texts labeled science fiction driving texts labeled literature off the shelves of the stores of the readers. Even the rise from practically zero percent to fourteen percent of fiction production in twenty-five years nor the rise from zero to about five hundred classes does not seriously threaten the production of texts of the sort we call, say, mundane fiction or poetry. There are too many other economic pressures in terms of universities and journalistic ones that would certainly bring the process to a grinding halt at fifty-fifty, if not well before. I am still talking about the encounter between discourses, between responses, ways of reading texts, ways of using the interpretive space around them.

There are many people who read only literature.

There are also many people who read only science fiction.

But there are also people who have moved from one to the other. The label "silly kid's stuff," so long applied

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to science fiction, was there to suggest that the natural and healthy movement over the period of maturation was from science fiction *to* literature, with its concommitent suggestion that any movement in the other direction implies mental softening. But of course there *are* many people recently who have moved in the other direction—another expression of the encounter.

I talked to one such man, not long ago. A historian, specializing in the beginnings of the nineteenth century, he had been a great reader of literature, but had found, over a period of five or six years, that he was reading more and more science fiction until, for the last two years, other than his journals and nonfiction, he had read nothing else. "I was really afraid to go back and read a 'serious' novel," he told me. "I didn't know what would happen. Finally, in fear and trembling, I picked up Jane Austin's *Pride and Prejudice,* always one of my favorites, just to see what happened when I did . . . Do you know something? I thoroughly enjoyed it, more than I ever had before. But I realized something. Before, I used to read novels to tell me how the world really was at the time they were written. This time I read the book asking myself what kind of world would have had to exist for Jane Austin's story to have taken place—which, incidentally, is completely different from the world as it actually was back then. I know. It's my period."

As far as I can tell, this man has started to read Jane Austin as if her novels were science fiction. There had been an encounter. And on some very deep level, part of the discourse of science fiction has triumphed over the discourse of literature here—without, I suspect, any significant rupture for literature.

I think I have made it fairly clear by now: I think that reading science fiction as if it were literature is a waste of time. I suspect that reading literature as though it were "literature" is also pretty much a waste of time. The discourse of science fiction gives us a way to construct worlds in clear and consistent dialogue with the world that is, alas, the case. Literature's unitary priorities do not. And in a world where such an "alas" must be inserted into such a description of it, the dialectical freedom of science fiction has to be privileged.

I have already said that reading science fiction as though it were literature is a waste of time. It is possible that, on the level of values, reading literature as though it were science fiction may be the only hope for literature—as long as while we're doing it, we don't commit the same sort of historical ruptures that we have already suffered at the hands of simply uninformed academics. And to read—and to write—science fiction as though it was *really* science fiction—and not just a philistine hack-job purveying the same unitary values as literature, simply in their most trivialized form, may be the only hope for the world. ■

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a twice-toed tale

Any similarities to existing public figures is . . .

George W. Harper

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8,133 A.D.

ABSTRACT: **Proceedings Terran Microgenetics Society; Vol. 6,934, Nr 10, pp 1,414-6. Per Baranyoff, A., & Philps, C.D.**

The principals, employing advanced microanalytic techniques on the gene bodies recovered from the naturally mummified body of an early Mars explorer (provisionally dated around 2,200 A.D., ±75 years), have rediscovered the genetic coding responsible for the primitive lower extremity characteristics at one time referred to as "feet" and "legs." These codes have been identified as appearing in microlinkages $\Phi|^{3}_{2}{}^{\cdot\cdot}\Psi|^{21}_{14}{}^{\cdot\cdot}\sigma|^{187}_{65}{}^{\cdot\cdot}\Theta|^{114}_{32}{}^{08}_{161}{}^{\cdot\cdot}\kappa|^{12}_{01}{}^{04}{}^{\cdot\cdot}\Omega|^{5}_{6}{}^{06}_{17113}{}^{\cdot\cdot}\beta|^{434}_{19}{}^{172}_{00}{}^{\cdot\cdot\cdot\cdot\cdot\cdot}$. Post-cloned variants confirm the findings and it is now considered feasible to decant humans with fully functional lower extremities of the primitive type.

8,134 A.D.

SCIENCE & THE CITIZEN DEPARTMENT: **Journal for the Propagation of Knowledge; Vol. 4,115 Nr 2, pp 30.**

Scholars A. Baranyoff and C.D. Philps have announced the rediscovery of the genetic coding for the primitive lower appendages once referred to as "feet" and "legs." Our early ancestors employed these as a method of personal locomotion until well into the first machine age but their use was discontinued late in the third millenium, at the onset of the second machine age. It is speculated this was done in response to the increasing complexity of the machinery of the era and an attendant requirement for an additional set of hands and arms to assist in the manipulation of controls. With the advent of the modern machine era and simplified control systems our secondary set of hands and arms are largely redundant and Scholars Baranyoff and Philps believe there may now be a practical advantage in the possession of feet and legs. Efforts are now underway to clone nonviable surrogates to examine the feasibility of the project. Should this prove successful the experiment will be continued with free-style clones and ultimately, perhaps, with personal successor clones.

8,134 A.D.

144 POINT HEADLINE: **Terran Enquirer, page 1.**

Scientists Plan to Create New Race of Cave Men!!

8,134 A.D.

ARTICLE: **Terran Enquirer, Page 5.**

Scholars Asimv Baranyoff and Crlos Philps, of the Nova Berne University, have recently instituted a new project to breed mankind back into the stone age! Working from the naturally preserved corpse of an early Mars explorer, the two scholars have recovered the genetic codes necessary to rebreed primitive body structures which they refer to as "feet" and "legs." These supposedly were possessed by our ancestors in place of the lower arm and hand pair! Scholar Philps also claims our first ancestors used these legs and feet in order to move from one place to another without the need of wheels.

According to information received by our reporters nonviable cloning

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experiments are even now underway at the university and the first results are expected any day. Our reporter made repeated efforts to enter the facility and photograph the symbions but was unable to penetrate the tight security there.

Informed sources attached to the university suggest this may be only the start of a far more ambitious plan to recreate a whole host of now extinct animals, with the next project being the production of a sabretoothed tiger, a ferocious beast reputed to have had an insatiable appetite for human flesh! Should one of these monsters be created and escape the university confines it might well be capable of devouring the entire population of a city before being brought to bay. Inhabitants of communities surrounding the university say they are living in continual dread of the creations of these microgenetic tinkerers and a number of legislators have announced an intent to bring the matter to a full investigation before permitting it to proceed further.

8,134 A.D.

LETTER TO THE EDITOR: Sent to 312 newspapers and printed in 310.

I am writing this to bring attention to the newest abomination of the scientists! Now we discover they intend to ruin us all by producing a race of deformed people having FEET instead of HANDS! They have absolutely NO RIGHT to ram this sort of thing down our throats and I PROTEST! It is against the laws of man and GOD! If the LORD had intended man to have feet HE would never have shown us how to get rid of them! The people of the world must UNITE to call a halt to this horror before it consumes us all. Write your elected representatives and order them to BAN THE FEET!

8,134 A.D.

MEMORANDUM: from R. Nedr to B. Abfrg.

Dear Bel.

Enclosed are clippings and an engineering sketch on this foot thing. According to the engineering data the central arch is an integral element of the structure of the foot and there is grave doubt whether it would be possible for it to stand up under continual use for 80 or 90 years. I see a distinct possibility it would eventually break down and become flat. Frankly, I fail to see how your consumer protection committee could possibly authorize the development of feet until all potential design flaws have been worked out and there is absolutely no possibility of failure by one of the units. I suggest you prepare a set of minimum guidelines before you permit the production of actual humans. As always, my organization stands ready to assist you by writing a set of proposed regulations setting standards.

Nedr

8,134 A.D.

MEMORANDUM: From B. Abfrg to R. Nedr.

Dear Rolf:

Like you, I am quite concerned with this foot business and definitely agree with you on the consumer protection bit. If the arch cannot be strengthened

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so there is no possibility of it going flat I simply do not see any way it should be approved for inclusion on actual humans. In addition, I suspect this is merely one more effort by the establishment to add to the burdens of the poor. By subtracting one set of hands they will be even less capable of making a living than they are now. I perceive the whole affair as part of the conspiracy to eliminate the entire under-privileged class.

While I'm at it, you might also be interested to hear there's a rumor going around that Baranyoff and Philps have included an antifertility linkage to the restructured genes and anyone pressured into accepting feet for his next surrogate will wind up terminated in about 80 or 90 years. They are literally killing off the entire next generation of poor people!

You know I am not given to passing on idle rumors so you can take it that this is on *very* good authority.

So far as my plans are concerned, I intend to introduce restrictive legislation before the World Congress within the next two weeks . . . but this probably won't get any farther than my other programs. Those bastards invariably sit on anything aimed at improving the condition of the poor.

Bel.

8,134 A.D.

EXTRACT: House Bill 14,871, 3,210th Session World Congress. Sponsors: B. Abfrg, B. Popoff, B. Osonovich.

BEING A BILL TO OUTLAW THE POSSESSION OF FEET AND LEGS

(Consisting of a preamble and 46 sections, with preamble only extracted)

DECLARATION OF INTENT AND PREAMBLE:

The Congress of Terra finds it not conducive to the welfare of its citizens that the appendages referred to as "feet" or "legs" be encouraged, aided, abetted or in any way made licit or lawful until such time as a full and complete examination of all possible hazards has been accomplished and appropriate safeguards are included in the project . . . . .

8,134 A.D.

ARTICLE: World Times, Page 5.

SCIENTIST DENIES ANTIFERTILITY CHARGES IN FOOT HEARING

Speaking before the Abfrg Committee hearings on proposed foot and leg legislation, Scholar Crlos Philps emphatically denied the existence of any antifertility linkages in the genetic recombination for feet and legs. Sch. Philps also startled the committee by informing them that his own surrogate has already been cloned and will possess the new structural features. He added he certainly would not risk termination if there was the slightest chance the feet and legs would render the new cells incapable of further cloning or if the structures would interfere with human fertility.

Responding to a challenge by the Reverend Bil McIntosh, chairman of the World Conservative Church Union, Sch. Philps pointed out that for the first several million years of man's existence he had feet and legs and that only within the last 5,000 years had they been discontinued. He

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added he felt this indicated a high probability that feet and legs would have no adverse effect on the reproductive system or the human species would have died out ages ago.

In related hearings, Sch. Baranyoff, replying to a challenge by Rolf Nedr, confessed it was possible that the arch segment of the foot would collapse under continued heavy use but denied this would be much of a problem. Nedr is demanding a total ban on all experimentation with feet until satisfactory guarantees of arch performance are received. When asked by Sch. Baranyoff how guarantees could be provided before experiments with actual models reveal the problems, Nedr stated it was the responsibility of the scientific community to arrive at acceptable procedures before ever undertaking a project.

8,135 A.D.

HEADLINE; Terran Enquirer.

INVASION OF FOOT-MEN LOOMS!

8,135 A.D.

ARTICLE: Terran Enquirer, Page 11.

Confidential sources within Berne University have confirmed the existence of a long waiting list of people demanding feet. Our informant revealed that already more than 250 successor surrogates have been cloned, with the first of them scheduled for decanting late next month. The waiting list, we have been informed, now exceeds 2,000! Several names have been mentioned among those already being cloned, most notable among them being Sch. Crlos Philps, the actress Jene Fondelle, wealthy sportsman Jules D'Mrko, tycoon Mark Rockfelow and the artist Juno Hyes.

Attempts to interview these and others have so far been unsuccessful, with each of them refusing to acknowledge our calls. It is also reported that the university's efforts to recreate the sabretooth tiger are approaching success and there is a strong possibility the first such animal is already in existence, being held behind locked doors in a carefully barred cage lest the ferocious animal escape and wreck havoc on the defenceless countryside.

We can only hope the bars are strong enough to resist the sledgehammer blows of the mighty beast!

8,135 A.D.

ARTICLE: World Times, Page 3.

NEDR FILES CLASS ACTION SUIT AGAINST FEET.

Charging that the arch formation of feet is inadequate to stand up under prolonged use, consumer advocate Rolf Nedr yesterday entered a class action suit against Scholars Asimv Baranyoff and Crlos Philps and the New Berne University to prevent the further decanting of surrogate or successor clones possessing feet. Nedr charged that in tests involving carefully constructed mechanical feet tested to destruction on a treadmill, the average life expectancy of the arch is only 11 months.

In a public announcement accompanying the filing of the suit, Nedr charged it was intolerable to subject surrogates or successors to a life with feet merely to please the vanity of a few old men and women. "Such tam-

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pering with nature must cease and the scientists must be told, once and for all, that they are the servants of the people, not their masters; and no casual tinkering will be tolerated," he said.

Responding to the charges, Sch. Baranyoff claimed the tests were excessively severe and in no way reflected probable use. He pointed out the mechanical feet carried a load in excess of 220 pounds and were subjected to 120 impacts per minute for 11 consecutive months before breaking down. Remarking that the average individual weighs around 160 pounds, Baranyoff went on to say that the tests were the equivalent of about 50 years of normal use. Baranyoff also pointed out that biological systems, unlike mechanical ones, have the capability of self-repair and that Nedr's tests, if anything, prove the reliability of the system.

8,135 A.D.

HEADLINE: Terran Enquirer.

UNIVERSITY DENIES SABRETOOTH!

8,135 A.D.

ARTICLE: Terran Enquirer, Page 9.

When approached by our reporter concerning the authenticity of rumors that the New Berne University is currently experimenting in hopes of recreating the sabretooth tiger, authorities there officially scoffed at the idea. Claiming "there is absolutely not the slightest truth in the allegations," Rector Baltus Scheissenboom attempted a blanket denial of any research to recreate extinct life forms.

When questioned more closely, however, Rector Scheissenboom admitted that research of the fossilized skeletal remains of extinct animals, including dinosaurs and sabretooths, has developed certain data concerning the gene structures of those animals. When asked whether this did not imply the possibility that someday such animals might be recreated, Rector Scheissenboom said, "I suppose the theoretical possibility may exist. Assuming we were to discover the complete genetic code for such an animal there would be no practical reason why we could not decant one, but we are certainly far from possessing such knowledge at this time. Frankly, I wouldn't even know how to start such a project."

Since Rector Scheissenboom is not himself a microgeneticist he conceded that others might have a better idea how to go about it than he, but he denied the possibility anyone on the New Berne campus was currently working on such a project. Despite these denials, however, our informant on the university campus insists research in this area is indeed continuing and efforts to redevelop the sabretooth are well under way.

8,135 A.D.

HEADLINE: World Times, Page 1.

FIRST FOOTED INFANT IN 5,000 YEARS DECANTED!

Yesterday afternoon, at 3:00 p.m., the Infant Crlos Philps #17, the free-style clone successor surrogate of Sch. Crlos Philps #16, was decanted at the new Berne University Medical Center. Young Crlos Philps #17 pos-

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sesses a set of fully formed feet and legs instead of the normal lower arm and hand pair.

The matter of feet and legs has been the occasion for considerable public discussion since it was first announced a little over 19 months ago and consumer advocate Rolf Nedr has demanded the clone be rejected in a class action suit still pending before the courts. When queried by the press, Scholar Philps said he was confident the suit would be found without merit and thrown out of court. Since the courts currently have backlogs of one to two years and the limit for clone rejection is six months from the date of decanting it would appear likely the case will be mooted so far as the Philps successor surrogate is concerned, but with nearly a thousand footed surrogates now approaching the decant time it is virtually certain the matter ultimately will be forced to a decision.

8,135 A.D.

ARTICLE (Excerpt): Bulletin of the Allied Federation of Churches, Page 1.

CONCENSUS SAYS FEET NOT AGAINST THE WORD OF GOD

Taking sharp issue with the position of the ultraconservative World Conservative Church Union, the ministerial governing board of the Federation released a position paper affirming the right of decision of clone parents to choose their next body style. Citing the already established right to select hair color and facial characteristics through microgenetic manipulation, the Federation stated that feet and legs were a simple extension of the basic principle and therefore not a matter of theological concern. The governing board also took issue with those who claim that if God had not wanted man to dispense with legs He would never have allowed mankind to learn how to eliminate them. Pointing out that it could also be argued that if the Lord had not wished us to get feet and legs back again He would never have permitted the Mars mummy to be discovered, the board said it could find no clear and unambiguous theological basis for an argument in either direction and the matter ought therefore to be left to the discretion of the individual.

8,135 A.D.

ARTICLE (Excerpt): World Conservative Church Union Witness. Page 1.

CHURCH DECREES AGAINST FEET

Speaking for the World Conservative Church Union, the Reverend Bil McIntosh declared in a press release issued last week that feet were manifestly against the will of God and that anyone electing to possess them was in danger of total damnation. In a carefully reasoned statement in which he cited relevant passages in the Bible, the Book of Mormon, the Koran, the Book of Lao Tse and the Bahai texts, Reverend McIntosh stated that while certain transient features, such as hair or facial characteristics, might properly be altered during the cloning process, fundamental features were not to be changed. "God," he stated, "created man in His own image, and while the face and hair color may differ

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from person to person, the eternal four arms and hands are visible manifestations of the Almighty and anyone tampering with them shows disdain for His Work and places his soul in jeopardy!"

"It matters not," McIntosh announced, "that the early ancestors of man did have feet and legs; 5,000 years of continuous nonpossession have sanctified it and to change would be to fly in the Face of The Lord! The Lord, in His Wisdom, showed man how to rid himself of the unneeded members and for man to reject this Revelation would be to turn his back on The Lord and to return to the days of Sodom and Gomorrah!"

8,136 A.D.

HEADLINE: Terran Enquirer.

HAAVAAD PROFESSOR CLAIMS MANKIND NEVER HAD LEGS OR FEET!

8,136 A.D.

ARTICLE: Terran Enquirer. Page 8.

Speaking before the prestigeous Alternative Society's annual convention in York, N.A. last June, Scholar Percy Handout, of the Haavaad University Department of Philosophical Archaeology declared that contrary to popular opinion mankind never possessed legs and feet. The error in belief arose, he said, because modern man has too uncritically accepted the surviving sculptural and tomb paintings as being actually representative of the true appearance of early man. Sch. Handout said that the extreme hardship of life in those days, coupled with the need to carry heavy burdens, led to a systematic hyperdevelopment of the lower arm and hand pair until they came to resemble genetically distinct body structures.

Scholar Handout said that complete proof of his thesis will shortly be made available in a popular textbook which will be on the stands late in August. "It is high time," he said, "that we stop this nonsense of feet and legs and accept the fact that man has always had four arms and four hands!"

8,136 A.D.

ARTICLE: World Times. Page 1.

BAN THE FEET GROUP PICKETS NEW BERNE U.

Approximately 300 pickets, carrying signs saying "Ban the Feet" showed up before the Microgenetics Center at the New Berne University yesterday. No untoward incidents occurred, but the protesters announced they intend to continue their picketing until the University agrees to discontinue all research and experimentation with feet and legs.

In related incidents, Rolf Nedr announced his intention to appeal the recent decision of the 54th Circuit Court declining jurisdiction in the matter of feet. Calling the decision "a travesty on justice" and saying the judge had "obviously been gotten to by the university scientists" Nedr said he had only just begun to fight and he would appeal it all the way to the Supreme Court in order to protect the people. Nedr also announced he would file separate law suits in regional jurisdictions throughout the world. "Perhaps we cannot stop the foot thing everywhere at the moment," Nedr

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said, "but this way we can put a stop to it in every jurisdiction where the judges are not too cowardly to stand up and act for the benefit of the people."

8,136 A.D.

EXTRACT: House Bill 00,072, 3,211th Session World Congress. Sponsors: B. Abfrg, B. Popoff, B. Osonovich, Theo Kendy, Bil Proxman, et al.

BEING A BILL TO OUTLAW THE POSSESSION OF FEET AND LEGS

(Consisting of a preamble and 193 sections, with preamble only extracted) DECLARATION OF INTENT AND PREAMBLE:

The Congress of Terra finds it not conducive to the welfare of its citizens that the appendages referred to as "feet" or "legs" be encouraged, aided, abetted, or in any way made licit or lawful. The Congress also declares an emergency and decrees that existing surrogates, notwithstanding that they may have passed the ordinary age limit of rejection, be terminated immediately upon enactment of this bill.

8,137 A.D.

ARTICLE: World Times. Page 1.

RAGEN DECLARES AGAINST FEET!

In a stinging speech delivered to the right-wing Terran Society meeting held in LsVegas, N.A., yesterday, former Western Region Governor Runny Ragen denounced the current "foot" fad as being part of the anti-social conspiracy being fostered by the outworlds and demanded the world government take immediate action to halt the spread of the unworldly contagion. Declaring that "four hands have been good enough for 5,000 years of ancestors . . . They are good enough for me!" Ragen announced a special fund raising drive among his conservative supporters to mount a campaign against feet. "Make no mistake," he warned his listeners, "this is war! And it is a war we intend to win!"

Ragen also said anyone wishing to contribute funds to help him in his crusade is invited to send them to his campaign headquarters or to the local branch of the Oak Society nearest their home.

8,137 A.D.

144 POINT HEADLINE: Terran Enquirer

DEADLY SABRETOOTHS ON PROWL!

8,137 A.D.

ARTICLE: Terran Enquirer. Page 3.

COLLAPSE OF BRIDGE LAID TO ESCAPED SABRETOOTH!

The sudden collapse of a bridge only 45 miles east of New Berne University last week has been associated with the rumored escape of a full-grown sabretooth tiger reportedly decanted from the research laboratories at the university early last year. Despite official denials, the bridge was certified as being structurally sound and capable of sustaining loads up to 35 tons. Since some reports indicate the weight of a full grown sabretooth may range upwards of 50 tons, the collapse of the bridge can be laid directly at the door of the university. Despite the connection, university spokesmen officially scoff at the possibility and continue to deny that any sabretooth tigers have been created. Instead they maintain that the bridge

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was old and unsound to begin with and claim that undermining by unusually heavy spring floods this year were the sole factor.

Regardless of university denials, people in the surrounding area are terrified of the monster and a number of them are reported planning to move away from the danger area in order to avoid almost certain death from the monster. The Enquirer is staying on top the story and pledges to keep its readership fully informed of developments as they occur.

8,138 A.D.

ARTICLE: World Times, Page 1.

COURT DECLINES JURISDICTION IN FOOT CASE

Citing the fact that the World Congress currently has under consideration a bill to regulate feet, the superior court at The Hague today rejected a class action lawsuit filed by Rolf Nedr which would have required rejection of any clones having feet. In its action the court said its function is not to preempt law but to enforce it, and since the legislative arm of government currently is considering the matter with an eye toward arriving at a specific law it was not the prerogative of the court to intervene.

When asked to comment on the court's decision, Nedr replied angrily that the justices had chosen the coward's way out. "The people are against feet," he declared, "and for the court to hide behind mere legalisms is contemptible! The will of the people cannot be thwarted by judges too timid to act decisively for the community when the occasion requires it."

Questioned concerning his future plans, Nedr said "Of course I plan to appeal. But his fight is going on on more than one front. I still have hopes the Congress will enact the Abfrg Bill and outlaw the whole thing, but if it does not, I plan to take the matter directly to the people. They are the final judges."

8,138 A.D.

ARTICLE: World Times, Page 1.

FIRST CLONE WALKING

Scientists at the New Berne University yesterday revealed that young Crlos Philps #17 has now been walking for several months. Now nearly 3 years old, Crlos was permitted to take his first steps at age 2 years 9 months. After a couple of falls during the initial learning process, Crlos is now quite adept at walking and shows no signs of difficulty maneuvering himself around the specially constructed play yard.

According to the head pediatrician assigned to his case, young Crlos was probably capable of walking about a year and a half ago but it was felt that premature over-exercising of the leg muscles might have adverse effects on his future development and he was kept in a conventional infant carriage until shortly before he commenced walking.

Although Crlos was the first footed child to be born, the number reported now exceeds 750, with approximately 2,000 more being readied for decanting over the next six months. When asked, the University acknowledged

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that applications for footed clones are not currently being processed. "The school must proceed cautiously on this," the spokesman admitted. "We are not unaware of the controversy surrounding the matter, and even though the Congress allowed the anti-foot bill to die in committee for a second time there is still a distinct possibility some future congress will adopt restrictive legislation. We are satisfied that the 2,750 footed clones currently scheduled will be fully adequate to provide a workable test sample which will permit a thorough evaluation of the potentials of this and related biosystems."

8,139 A.D.

144 POINT HEADLINE: **Terran Enquirer.**

FOOTED CLONES THREATEN TO OVERRUN EARTH!

8,139 A.D.

ARTICLE: **Terran Enquirer, Page 4.**

UNIVERSITIES DECANTING CLONES BY THE MILLIONS!

The recent discovery that at least five other research centers besides New Berne University are now cloning footed surrogates comes as a stunning shock to the world! Where earlier figures indicated no more than perhaps 3,000 of the creatures were being decanted, now the figure is ranging up into the tens of thousands, with no end in sight!

When coupled with the discovery by Scholar Percy Handout, of Haavaad University, that mankind has in fact never possessed feet or legs, it becomes evident there is far more to the foot situation than has yet been disclosed. There is now considerable speculation among reputable scholars that the supposedly "human" space explorer found on Mars was in reality a carefully constructed imitation carrying concealed gene structures aimed at wiping out the whole human race so alien beings can take over! The devastating revelation that whole hordes of these alien beings are being decanted all over the world is frightening in its implications.

8,140 A.D.

LETTER TO "DEAR AUNTIE": **World Times plus 10,000 other newspapers.**

Dear Auntie:

I'm at my wit's end and desperate for your help. I am a 26 year old married woman who was deleriously happy when my husband and I received permission for a gene-mix new birth to replace an ancestor whose life failed before he could be recloned. This was to be one of the happiest events in all of my lives. But now my husband is insisting he wants the new child to have FEET! Auntie, I'm just not equipped to handle something of this sort. I'm really an old-fashioned sort of girl and want my baby to be like all the other babies and I am miserable over the prospect of bringing some deformed monster into existence. What should I do?

Wretched in Cairo

8,140 A.D.

REPLY TO WRETCHED: **World Times plus 10,000 other newspapers.**

Dear Wretched:

Like you, I am hurt at the thought of bringing a deformed child into this

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world and feel your husband is showing himself insensitive and cruel. Parenthood is not the place to experiment with fads, and children coming into this world have problems enough without having more added by genetic tinkering designed to make them a public spectacle. Talk to this husband of yours and get him into counseling if you can. If nothing works show him the door and hope for better luck the next time.

8,140 A.D.

ARTICLE: **World Times, Page 1.**

RAGEN RAISES 50 MILLION TO BATTLE FEET

In a press release issued late yesterday, Runny Ragen revealed his war chest for the campaign against feet has now passed the 50 million mark, with more pouring in every day. Ragen says he expects to have nearly 75 million before the end of the year. When asked to disclose his plans Ragen said some elements are necessarily secret but that a considerable amount would be spent defeating legislators who refused to act decisively to stamp out the swelling menace to mankind. Declaring he would "die rather than accept feet," Ragen said the ultimate goal was the total extermination of feet and a return to the tried and true methods which had made this world great.

8,141 A.D.

144 POINT HEADLINE: **Terran Enquirer**

FOOTED CHILD SENDS NURSE TO HOSPITAL!

ARTICLE: **Terran Enquirer, Page 2.**

2-YEAR OLD MONSTER NEARLY KILLS HIS NURSE!

The first casualty of the foot war was reported recently when 2-year old Marc Hamburg kicked his nurse in the face while she was changing his diaper and sent her screaming in pain to the hospital with a serious concussion and bruises. In near hysteria after her ordeal, Nurse Emily Kilbry announced she was filing suit against the surrogate's alter ego for an as yet undisclosed amount.

The unexpectedly powerful force of this kick proves the contention of this paper that the whole foot phenomenon is part of a desperate plot by other worldly creatures to exterminate the human race. If one blow from the foot of a mere 2-year old can cause concussion and serious harm to an adult, what would be the effects of similar blows by a fully footed adult? Posing this question to a noted scientist who asked that his name not be disclosed, the Enquirer was informed that the physical abilities of infants tend to double as their age doubles. A 4-year old will therefore have twice the power of a 2-year old. An 8-year old will have twice the power of a 4-year old and a 16-year old will have twice the power of an 8-year old. Calculating from this it is evident that by the time these footed creatures reach their maturity each foot will be capable of exerting force sufficient to kill 10 ordinary humans! With nearly 10,000 footed creatures already here on earth and more arriving every day, can the end be far distant?

8,142 A.D.

ARTICLE: **World Times. Page 1.**

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WEA ANNOUNCES AGAINST FEET!

Teachers of the World Educational Association, meeting in Manila this week for their annual convention, voted overwhelmingly to condemn the use of feet. Delivering a record 84.5% vote against feet, the 34,000 teachers declared that footed children appear to be more inattentive in class, more inclined to disrupt decorum by using their feet to race up and down halls and are generally more restless than normal children. The association also declared there seems to be evidence that footed children are somewhat slower learners than the average however a minority report, endorsed by 12% of the teachers, suggested that this might be attributable to diversification of interest caused by the possession of feet rather than any actual reduction in intelligence.

The report urged that footed children be placed in special educational centers where they would not be required to come in contact with normal children, at least through the first 10 years of their schooling. In a related action, the World Association of School Administrators unanimously went on record to request special training facilities for footed children. Declaring that feet are a positive threat to the educational process, the administrators requested that local parent-teacher organizations bring pressure to bear in their local communities and push for laws requiring footed children to make use of conventional personal transportation units during school hours. Dr. Oslo Bull, this year's chairman of the W.A.S.A., speaking for the whole assembly, said "If people wish to have feet, that is their business. But they have no business bringing their feet into schools. They should enter their personal transport units at home, come to school the same as any other children, then return home in their units. If they then wish to spend some time walking or practicing with their feet they may do so . . . but not around the schools."

8,142 A.D.

ARTICLE: World Times. Page 1.

CALIBAN WARNS AGAINST FEET

Secretary Caliban, of the World Department of Health, Education and Welfare, today cited growing evidence that the possession of feet somehow has a negative effect on intelligence, and suggested that people go slow in adopting the innovation. "Both boys and girls with feet," he said, "seem to want to be out running around rather than staying in class attending to their studies." According to Caliban both boys and girls complain of the necessity to be confined in personal transport units and continually seek excuses to get out of them and walk around. Academic performance suffers and such youths tend to lag considerably behind normal children.

Sources within DHEW say current research suggests there may be a maximum level of sensory input acceptable by the brain. The presence of feet and legs inpinges on regions of the brain associated with intelligence and serves to reduce the over all Intelli-

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gence Quotient of the youngster.

Some scientists outside DHEW argue that this is a purely temporary phenomenon and that the children will soon overtake their footless contemporaries by virture of a greater total sensory experience, but DHEW scientists scoff at this interpretation and claim that the presence of feet implies at least a 15 point reduction in 10.

8,142 A.D.

ARTICLE: Brigham Law Review, Vol. 4,113, pp. 1,662-9 (Abstract Only.)

LEGAL IMPLICATIONS OF FEET

Assuming no preemptive action to outlaw feet entirely, it is evident a need for redefinition of existing laws will soon arise. For example, it is currently assault to strike another person with the open hand, with the clenched hand, with the fist or with the arm with intent to cause hurt or injury. This law, however, obviously neglects to consider the implications of striking an individual with a foot. Existing law recognizes the distinction between the open-handed slap and the closed-fist blow, with the former constituting assault in the third degree and the latter assault in the second degree. Attacking another person with the foot, on the other hand, is clearly not definable in terms of flexure of the toes and on dynamical grounds the only differences would seem to be centered around the relative force applied through the muscles of the upper leg.

These, and related problems, will be considered in the following paper and recommendations for appropriate changes in criminal and tort codes will be advanced.

8,143 A.D.

ARTICLE: World Times, Page 1.

SINGER NITA BRANT MARCHES AGAINST FEET

Citing a personal revelation by God, the noted folk singer Nita Brant yesterday kicked off her own crusade against feet. Claiming that feet are a sign of rebellion against God, Mrs. Brant said she knew it would ruin her career and no doubt some footloose individual would one day assassinate her but she was resolved to continue. "God is on my side," she announced in a prepared release. "They are unnatural and an abomination to the Lord. I have prayed over this thing and asked the Lord for guidance. With His Hand leading me I cannot fail!"

During the question and answer period following her announcement, Mrs. Brant was asked how she justified her view of footed people as 'abominations' when the book she was citing said she should love even her enemies. Replying, Mrs. Brant declared, "Of course I love them! The Lord says I must love them, so I do. But while I love them as persons I cannot love the error of their ways. They must be stopped before they take over the world and corrupt everything in it. They have to be kept apart . . . in prisons or hospitals or something. Either that or we should cut off their legs and graft on arms so they will be like everybody else. Then we should reeducate them so they accept the error of their ways.

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"Its all I ask. Its all the Lord asks!"

Following this announcement, Mrs. Brant went on to say she was currently setting about organizing voter groups throughout the world to overturn any tolerance laws which might serve "to encourage those deviates."

8,145 A.D.

ARTICLE: World Times, Page 2.

RAGEN SWEEPS SOUTHWESTERN N.A.

Runny Ragen, campaigning vigorously against feet, today announced victory in his close-fought race against feet. Sweeping the southwestern region of North America, a slate of electors pledged to fight feet by every means won a narrow victory in yesterday's elections.

Ragen was helped in his race by folk singer Nita Brant, who has been running around the world sponsoring local elections against feet. Mrs. Brant made a record 42 appearances during the last three weeks of the campaign and her aid is credited with picking up the required votes necessary for Ragen's victory.

Obviously jubilant over the victory of his slate, Ragen announced "This is only the beginning! Before we are through we will destroy every last foot in the world. It may take a lot of legwork before it is done, but we will win! The good old Terran virtues will triumph in the end."

8,146 A.D.

MEMO: Chairman, World Department of Transportation, to Ad Hoc Committee on Feet.

SUBJECT: Procedures for the Control of Foot Traffic:

1) Although not yet much of a problem by virtue of the relatively young ages of even the oldest foot-people, it is nonetheless clear and evident that the foot has potential utility as a means of personal transportation from one location to some other location. As such this implies a requirement for the appropriate control measures to prevent traffic conflictions and possible injury to persons either directly engaged in foot traffic or to persons who, though not themselves engaged in foot traffic, may still be injured or otherwise inconvenienced through the actions or negligence of those engaging in the above mentioned foot traffic.

2) To this end I am directing the addition of a new chapter to the World Transportation Administrative Code (WTAC), spelling out the procedures for the control of foot traffic; such chapter to be contained within Volume 157 of the administrative code, chapters 1 through 999 being reserved for needed regulations.

3) Pending the development of such code, the following general rules shall be adhered to and shall have legal force until such time as the full set of rules may be codified. As developed, additional rules may be enacted by codicillary actions:

PART I: GENERAL RULES:

A. No person shall be authorized to engage in foot traffic or to act as a pedestrian except upon proper licensing by the appropriate agency of government.

B. Prior to the receipt of a pedestri-

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an license the applicant must demonstrate a knowledge and understanding of the rules of pedestrianism and have passed a written and practical examination in which he shall have successfully maneuvered on foot through a test course provided by the licensing agency.

C. No person shall be authorized a beginner's license to practice walking until he or she shall have passed their 16th birthday and have demonstrated a written understanding of the limits of pedestrianism.

PART 2: FINANCIAL RESPONSIBILITY:

A. No person shall engage in pedestrianism except that he shall carry on his person at all times a valid pedestrian license with an endorsement guaranteeing financial responsibility for any actions or mishaps arising from his pedestrianism.

B. Any person apprehended while not in possession of a valid license on his person, which license shall carry his financial endorsement, shall be guilty of a simple misdemeanor and shall be punished by a fine not to exceed $250.

C. Any person apprehended walking while either altogether lacking a valid license or during a period when such license has been suspended or revoked, shall be guilty of a gross misdemeanor and shall, if convicted, be subject to a fine not to exceed $750 plus confinement not to exceed 6 months.

PART 3: LICENSE FEES:

A. Pending legislative action, each governmental district shall establish its own fee system for pedestrianism, but under no circumstances shall a fee of less than $25 per year be charged for the privilege of walking.

B. A valid license issued by one governmental district shall be honored by all such districts, however a person changing residence from one administrative district to another shall be allowed a maximum of 60 days before taking out a new license in the district of his residence.

PART 4: RULES OF THE ROAD:

A. Pedestrian traffic shall always proceed to the right of the oncoming stream except in the British Isles, Australia and New Zealand, where such traffic shall always proceed to the left of the oncoming stream.

B. Illegal crossing of median strips shall be a misdemeanor and may be punished by a fine not to exceed $25 for the first offence and $50 for each subsequent offence if committed within 6 months of the first.

C. No pedestrian shall proceed at a pace more rapid than 120, thirty-inch steps per minute. Movement in excess of this shall constitute a gross misdemeanor and shall be penalized by a fine not to exceed $25, plus $5 for each step over the maximum 120 per minute for the first offence and twice that for each subsequent offence. Repetition of the offence three times within a two-year span shall be cause for the revocation of the walking license. The taking of strides longer than the specified 30 inches shall also constitute a misdemeanor and shall be considered as a separate and divisible

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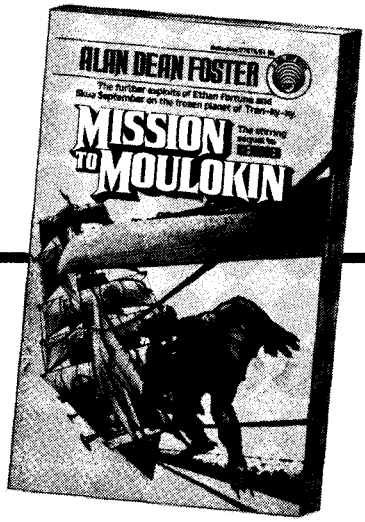

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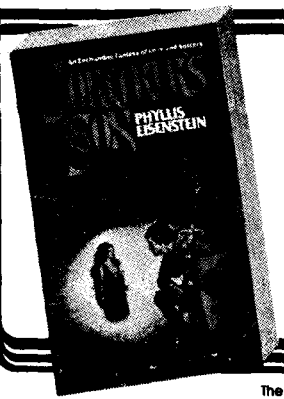

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offence. The penalty for any violation of stride lengths shall be a base fine of $25 plus $5 for every inch, or fraction thereof, in excess of the prescribed 30 inches. Three repetitions of the offence within a two-year span shall be cause for the revocation of the walking license.

PART 5: PROCEDURES IN THE EVENT OF ACCIDENT:

A. Should two pedestrians make physical contact with each other both shall come to a full stop and shall remain in position until released by competent authority.

B. Should two pedestrians involved in an accident be in a position which seriously interferes with other traffic the two may, upon consultation and agreement, move to the side of the walkway and there remain until released by a duly authorized officer of the law.

PART 6: PERSONAL EQUIPMENT:

A. Every pedestrian shall carry a radar reflector and transponder upon his person at all times when engaged in walking. Failure to comply, or the presence of any device intended to interfere with radar surveillance shall be considered a gross misdemeanor and shall be penalized by the revocation of the privilege of walking.

4) The rules cited above shall take effect upon publication.

5) Members of the Ad Hoc Committee on Pedestrianism are invited to comment on the above, but it is to be understood that the finalized chapters shall, in general, coincide with the spirit of the temporary rules codified above.

Chester A. Leghorn
Administrator

8,157 A.D.

ARTICLE: World Times, Page 3.

POLICE ANNOUNCE CRACKDOWN ON HOTFOOTERS!

World Bureau of Investigation Chief, J. Edgar Yerk, citing the steadily increasing number of youthful, unlicensed pedestrians engaged in drag racing down the streets and in seldom used areas of the public parks system, announced a general crackdown times to coincide with similar crackdowns by the local policing authorities.

According to Yerk, the majority of these youthful offenders are not even licensed pedestrians and many are as young as 7 or 8. Declaring that this menace cannot be permitted to continue, Chief Yerk said that in the future any minor apprehended while racing or engaged in unlicensed pedestrianism will be turned directly over to the juvenile authorities. "We are tired of talking to these young punks," Chief Yerk announced, "From now on we are going to act!"

8,159 A.D.

HEADLINE: Terran Enquirer.

NITA BRANT CLAIMS VICTORY NEAR IN WAR AGAINST FEET!

8,159 A.D.

ARTICLE: Terran Enquirer, Page 9.

SINGER CLAIMS GOD REVEALED VICTORY

Singer Nita Brant, citing a personal revelation from God, announced a

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coming victory in the war against feet. Claiming that over 500 local jurisdictions have now voted to deny footed persons special accommodations and the right to demand employment despite their possession of feet, Brant declared victory is "just a few feet away."

8,160 A.D.

ARTICLE: World Times, Page 2.

RAGEN CLAIMS SUCCESS NEAR ON BANNING FEET

Citing the various troubles which have arisen since people started having feet, Runny Ragen claimed yesterday it is only a matter of time before the possession of feet is outlawed throughout the world.

"No matter what happens on the outplanets," he declared, "the rights of a few thousand footloose nonconformists cannot be balanced against the welfare and rights of billions of honest, hardworking earthmen."

Reaffirming his inalterable opposition to feet, Ragen said that nearly twenty percent of all footed people had been apprehended breaking the laws by hotfooting and running on the streets and in the public parks. "Not a solitary nonfooted person has done this," he said. "This proves the entire footed population is nothing but a criminal class which will destroy us all if we don't put an immediate halt to them."

8,161 A.D.

144 POINT HEADLINE: Terran Enquirer

NEW PROOF FEET ARE AN ALIEN PLOT!

8,161 A.D.

ARTICLE: Terran Enquirer, page 19.

PSYCHIC PROVES FEET ARE ALIEN

A group of psychic investigators studying the foot menace has uncovered new proof of their alien origin. In a psychic breakthrough of major proportions, the Reverend Cloyd Bul, of Hammd, N.A., made contact with Chief Screaming Sparrow, an ancient American Indian who died nearly 25,000 years ago when Atlantis sank beneath the seas. According to Chief Screaming Sparrow the present limbs which we call feet were nothing like the feet he had in life and are, in fact, totally unlike any feet ever possessed by humans. The Reverend Bul claims Chief Screaming Sparrow provided him with material proof which he intends to present to the World Congress in their forthcoming session. Full details are to be given in his forthcoming book, which is expected to be on the stands next month.

8,163 A.D.

EXTRACT: House Bill 00,041, 3,229th Session World Congress. Sponsors: B. Abfrg, B. Popoff, B. Osonovich, G. Kenndy, H. Adms, J. Cordy, G. McGordon, W. Proxman, W. Dill, J. Utaha, et al.

BEING A BILL TO OUTLAW THE POSSESSION OF FEET OR LEGS

(Consisting of a preamble and 4 sections, with preamble only extracted)

DECLARATION OF INTENT AND PREAMBLE:

The Congress of Terra finds it not conducive to the welfare of its citizens that the appendages referred to as "feet" or "legs" be encouraged, aided, or in any way made licit or lawful. The

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Congress also declares an emergency and decrees that existing surrogates, no matter what age, be rejected from. . . .

8,163 A.D.

ARTICLE: World Times, page 1.

FOOT BILL NARROWLY DEFEATED, RAGEN VOWS TO CARRY ON

Obviously pleased by the unexpectedly narrow defeat of the foot bill, Runny Ragen announced today that he had only begun to fight. Jubilantly predicting success next year, Ragen said the vote indicated a healthy swing back to conservative principles and a renewed determination of the people to do away with governmental interference in their lives.

8,164 A.D.

ARTICLE: Bunny Magazine, Page 115-123 (Extracted)

SEX AND THE FOOTED WOMAN

After having had a number of interludes with normal women I have to confess I had a certain curiosity to see how girls with feet and legs would handle sex. Would there be any danger of slipping out now that there were no extra arms to help hold on?

Well now I know, and while it is true the absence of the lower arms does pose a few problems I can assure all our readers there are some interesting advantages to sex with legs.

8,165 A.D.

LETTER TO DEAR AUNTIE: World Times and 10,000 other newspapers.

Dear Auntie:

I hope you can help me. I am in love with a man who has feet and I don't know what to do about it. My parents would be shocked to death if they ever found out about Burk and I am even afraid to be seen with him on the streets (we live in a small town of only about a million population, so everyone would know). I have talked with Burk and he says he loves me too. He wants to marry me and take me to some other city where no one will know us, but I want him to have those legs cut off and a set of arms and legs grafted from a nonviable clone. I feel if he really loved me he would be glad to do this, but he says he enjoys his feet too much to let them go. What do you think?

Perplexed and in love

8,165 A.D.

REPLY BY DEAR AUNTIE: World Times and 10,000 other newspapers.

Dear Perplexed:

Like you, I feel that if Burk really loved you he would be willing to get those ugly legs and feet cut off. But then if you really loved him they wouldn't matter and you would go away with him. Cool it dearie; neither of you is right for the other.

8,166 A.D.

EXTRACT: House Bill 00,002: 3,231st Session World Congress. Sponsors: B. Abfrg, B. Popoff, B. Osonovich, G. Kenndy, H. Adms, J. Cordy, G. McGordon, W. Proxman, W. Dill, J. Utaha, et al.

BEING A BILL TO OUTLAW THE POSSESSION OF FEET OR LEGS

(Consisting of a preamble and 3 sections, with preamble only extracted)

DECLARATION OF INTENT AND PREAMBLE:

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BIOLOG

Becoming one of the regular Analog cover artists just recently, beginning with the March, 1978 issue, Paul Lehr is nonetheless a major science fiction illustrator of more than twenty years standing. His first science fiction cover was sold to a paperback publisher in 1958 for Satellite E One by Jeffrey Lloyd Castle. That illustration was produced from a combination of imagination and a table-top spaceship model the artist created from a ping-pong ball, toilet paper cardboard roll, wire, and miscellaneous parts.

More than ten years before the first lunar landing, Paul did a double-page painting for a story of the first landing that appeared in The Saturday Evening Post with the August 8, 1959 issue. If you'd like to see the painting, stop by the National Air and Space Museum at the Smithsonian Institution in Washington, where the original of the Post illustration is on permanent exhibition.

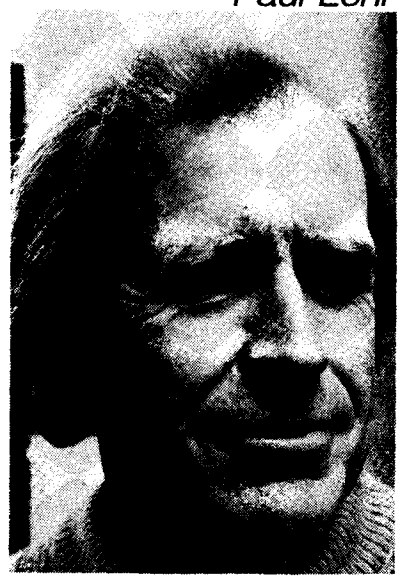
Paul's cover art has appeared on many paperback science fiction books, including novels by Robert A. Heinlein and Arthur C. Clarke. He himself is not an avid reader of science fiction, but is someone who is able to visualize what a writer has created in the mind's eye and render it visible on paper.

He was trained at Wittenberg University in Springfield, Ohio, where he received a Bachelor of Fine Arts degree in 1951, and the Pratt Institute in Brooklyn, New York, which awarded him a Certificate in Illustration in 1956. Afterwards, he studied with Stanley Meltzoff in Red Bank, New Jersey.

Born in White Plains, New York, Paul now lives on a farm in Pennsylvania, working in wood and stone whenever he can take time from his very busy painting schedule to indulge a private passion for sculpture.

by Jay Kay Klein

Paul Lehr



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The Congress of Terra finds it not conducive to the welfare of its citizens that the appendages referred to as "feet" or "legs" be encouraged, aided, or in any way made licit or lawful. The Congress also declares an emergency and decrees that existing surrogates, regardless of age, be rejected . . . .

8,166 A.D.

ARTICLE: World Times, Page 1.

FEET OUTLAWED! RAGEN JUBILANT

Climaxing 33 years of controversy the Congress today enacted a law prohibiting the possession of feet and banning the microgenetic linkages which give rise to them. The 4 million persons above the age of 6 months who are possessed of feet have been directed to report to the nearest clone center where they will be retained until corrective surgery can be performed using nonviable clones for grafting. Clones below the age of six months are to be disposed of and replaced by normal surrogates.

Coincidental with his success in having Congress outlaw feet, Runny Ragen announced he would once again stand as a candidate for World Chairman. Declaring that "This victory confirms my faith in the people of the world," Ragen said his campaign demonstrated a decisive swing to the right among the electorate and a return to a true value system based on individual initiative and a refusal to tolerate endless governmental interference in the affairs of citizens.

8,166 A.D.

144 POINT HEADLINE: Terran Enquirer

FOOT MENACE DEFEATED!

8,166 A.D.

ARTICLE: Terran Enquirer, Page 2.

ENQUIRER EFFORTS SAVE WORLD!

Thanks to the unremitting efforts of your Terran Enquirer, the World Congress has finally come to recognize the menace of alien feet and has now outlawed them everywhere on Earth!

But while this has been one victory for mankind it by no means indicates the war is over. You may be certain the enemies of mankind will not give up this easily. In a few weeks or years they will conceive some new diabolic scheme to destroy us all. But your Terran Enquirer can be counted on to stand in the forefront as a shield to alert you to each such plot as it is uncovered!

14,133 A.D.

ABSTRACT: Proceedings of the Terran Microgenetics Society: Vol 12,934, pp 1,414-6. Per Zukr, O. & Orix, P.

The principals, making use of microdate uncovered in the course of a research project exploring the archives of the University of Barn, announce they have rediscovered the coding responsible for the primitive lower extremity characteristics at one time referred to as "feet" and "legs." These codes are identified as appearing in the microlinkages identified in the main body of the text. Nonviable clones confirm the accuracy of the findings and it is now considered possible to develop humans with fully functional lower extremities (feet and legs) of the primitive type . . . . . ■

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THE ALTERNATE VIEW

Herewith begins a new department, wherein G. Harry Stine and Jerry Pournelle take turns reporting on very late developments in science and technology. This month, a new angle in man-computer cooperation. . . .

biocybernetics BY G. HARRY STINE

NOTE: *This is the beginning of an experiment. Some science fiction magazines have a science fact department written regularly by a single author.* The Alternate View *will be written by two well-known science fiction and science fact authors, Jerry Pournelle and G. Harry Stine. Both have similar backgrounds in the aerospace and domestic industries, but it is inevitable that each of them will bring a different perspective to this department.* The Alternate View *will be written by Pournelle and Stine alternately. Reader comment, critique, kudoes, and brickbats are hereby solicited; your letter may not get answered, but it will be read. SS*

While many people have been thrusting along with their eyes glued on the stars and their thoughts preoccupied by extraterrestrial imperatives, space enterprise, Solar System civilization, or the "limits to growth," a quiet revolution has been taking place in the back rooms where a synthesis is being made with biology, psychology, electronics, and computer technology.

Recently, an unclassified document found its way into my hands: the Defense Advanced Research Projects Agency (DARPA) Fiscal Year 1979 Program for Research and Development. This slim, forty-four page document deals mostly with DARPA's request for money for its various R&D programs in the area of military applications—space surveillance, weapons systems, command and control systems, etc. But, stuck in the back of the report is a section innocuously labelled, "Accomplishments."

Since the whole document is unclassified and most of the DARPA work has a classification one level below

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"Destroy Before Reading," the wording isn't very specific. But, if one has any background or knowledge in modern physics, one can glean considerable information from the covertly-worded statements. The "Accomplishments" section discusses high-power lasers, advanced infra-red focal plane arrays, and new warhead designs.

Plus a paragraph concerning "biocybernetics."

At this point, I switched out of the speed-read mode and into "careful study" mode. For over fifteen years, I have been interested (and done some work) in the area of the interface between the human nervous system and computers or electronic circuits. I have been interested in how to get information directly out of the human nervous system and into an electronic circuit, and vice versa.

DARPA has apparently succeeded in the former. They report that they have extracted useful information from an electroencephalogram (EEG) and "other nonverbal signals." They claim to have demonstrated a method of assessing the spare mental capacity of a human being on a moment-to-moment basis without interfering with the performance of the task. They have been able to measure EEG components associated with decision-making and with action.

DARPA has discovered that when a person performs a task at high speed, the EEG components associated with decision making and with action begin at about the same time. If the decision-making signal ends before the action signal, it means that there is a very high probability that correct action has been taken. However, if the decision-making signal continues after the action signal ceases, the error probability is high. DARPA researchers have learned, therefore, how to use the EEG to measure doubt and to assess the probability of correct human action without knowing what the correct action really is.

Interesting! That means that you slap on your EEG helmet, just like an old SF illustration. The output is fed to a series of amplifiers and to a high-speed general purpose computer that monitors everything and, if necessary, says, "Uh, Joe, I think you should reconsider your last choice!"

DARPA has done more than this; they have figured out how to beat the game in Las Vegas by demonstrating a new method of monitoring human probability assessment using the EEG. As a species, we are pretty good at guessing the right answers with minimal data, especially in military situations—just look at history. However, DARPA found that one EEG component (and they are not saying which one) is a very good indicator of "true" probability. This does not demonstrate, they are careful to point out, the so-called "gambler's fallacy" which says that if there have been ten heads thus far, the next toss must come up tails.

For many years, I have suspected that there is a great deal of information hiding in an EEG. In the first place, the instrumentation has been

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very crude. The electronics and the recording machinery have been Early Lord Kelvin in terms of state-of-the-art with frequency ranges from DC to perhaps 100 hertz. Since the human nervous system is composed of elements having a reaction, response, or relaxation time of perhaps 200 milliseconds, this sort of frequency response is just barely adequate to see a single synapse synap. But, as Dr. Warren S. McCulloch amply demonstrated, an organic nervous system appears to be a multi-channel redundant system that attains a very high apparent speed and a large data rate. So, with 100-hertz range, we are seeing only the gross system signal. What does it look like with a 10 megahertz bandwidth? I guess that DARPA has found out. And it is certainly something that other investigators can look into with ease, given today's microelectronic chips, etc.

But this work has some fascinating implications above and beyond the immediate and obvious ones.

Dr. Henri M. Coanda once told me that we are "colloidal" computers using a chemical system requiring the transfer of ions through a chemical medium to produce data bits; it is slow but makes up for this by being multichannel. On the other hand, electronic computers are "crystalline" systems working on the atomic level with the data bit consisting of electrons moving through a crystal lattice; this crystalline system is very fast.

How do we bring these two differ-

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ent systems together so that they can enjoy the advantages of a direct link? Right now, the linkage is incredibly slow; it is down on the mechanical level. We have to talk to the computer through a mechanical keyboard or through sound waves. The computer talks to us through a print-out (mechanical), sound waves, or a CRT display (mechanical because we have to read it and translate from CRT display symbols to nervous system signals).

The true symbiosis between a human being and an electronic computer results, primarily, in an "intelligence amplifier" for the human beings (if we've got any smarts at all about how to put the combination together) rather than turning the human being into a robot extension of the computer. To do this, direct links between the human nervous system and the computer circuits is required.

There are numerous problems involved in doing this, not the least of which is the little matter of *six orders of magnitude* difference in the response/reaction/relaxation times of the two systems. The colloidal system works in the millisecond range; the crystalline system presently works in the picosecond range and may eventually work faster than that.

Direct linkage may overtax the colloidal system, but, if the system had emotions, the crystalline system would be *bored*. Imagine sending a message and having to wait *six years* for the message to be received and decoded, much less replied to! This is the way a modern general purpose computer would view communication with a human nervous system. Using today's very slow periferals, it is no wonder that most general purpose computers are capable of considerable time-sharing.

This discussion has some other angles and ramifications that cannot be shoe-horned into the space available this time around. There is much more to be said about it, and I will say it after Jerry has had his licks.

For example, if DARPA has now demonstrated the capability of a direct link from human nervous system to a computer through the electroencephalogram, how about the other way around? Can the human nervous system direct-link with the electronics of a computer? Is this a two-way street?

The answer is yes. It has already been done, and I have personally experienced it. The technology has been sitting there for *seventeen years*, and nobody has paid any attention to it. So we will drag it out into the illumination of public disclosure.

In the meantime, do not write to me asking to know more about the DARPA work with biocybernetics and the EEG. I have told you everything that I know about it. Go bother the Pentagon. Here's the address to write to for more data, if you can get it (and good luck). ■

Dr. Robert R. Fossum, Director
Defense Advanced Research
Projects Agency
Dept. of Defense
Washington DC 20301

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SF A Calendar of Upcoming Events log

4-6 May
BRIDE OF PARACON (SF conference) at State College, Penna. Guest of Honor—Norman Spinrad, GoH Emeritus—Jack L. Chalker. Registration $5 until 31 March, $7 at the door. Info: Bride of Paracon, c/o Bob Casto, 425 Waupelani Dr., 24, State College PA 16801.

4-6 May
DUBUQUON II (SF conference) at Julien Inn, Dubuque, Ia. Guest of Honor—Charles Grant, Fan Guest of Honor—Lou Tabakow, Toastmaster—George R.R. Martin. Registration $6 in advance, $8 at the door. Info: Gail Burnick, Burnick+Martin Manor, 2266 Jackson, Dubuque IA 52001.

25-27 May
JUST IMAGICON (Memphis area SF conference) at Rivermont Hotel, Memphis, Tenn. Guest of Honor—L. Sprague De Camp. Artist Guest of Honor—Frank Kelly Freas. Film program, masquerade, banquet. Registration $10 until 1 April 1979, $15 thereafter and at the door ($6 supporting/non-attending). Banquet $10. Info: Louis Armour, 4475 Martha Cole, Memphis TN 38118.

25-27 May
V-CON 7 (British Columbia SF conference) at Gage Towers, University of British Columbia. Guest of Honour—Jack Vance. Toastmaster—Frank Herbert. Registration $6 (Canadian) until 18 March 1979. Info: V-Con 7, P.O. Box 48701, Bentall Station, Vancouver BC Canada V7X 1A6.

23-27 August 1979
SEACON 79 (37th World Science Fiction Convention) at Metropole Hotel, Brighton, U.K. American Guest of Honour—Fritz Leiber, British Guest of Honour—Brian Aldiss, Fan Guest of Honour—Harry Bell, Toastmaster—Bob Shaw. Registration $10.00 (supporting) $20 (attending). Info: Seacon '79, 14 Henrietta St., London WC2E 8QJ, U. K. This is the science fiction world's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, banquet, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer.

ANTHONY LEWIS

*Items for the Calendar should be sent to the Editorial Offices, **four months** in advance of the issue in which you want the item to appear.*

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"—ten thousand years from now, there can be little doubt that the most significant event of the 19th century will be judged as Maxwell's discovery of the laws of electrodynamics. The American Civil War will pale into provincial insignificance in comparison—"

RICHARD P. FEYNMAN
Nobel Laureate in Physics

"old friends across time"

Paul J. Nahin

As I sit here in my study, with the photographic evidence spread before me, I can barely comprehend what my eyes tell me must be so. The evidence is incontestable. And yet—I still struggle to believe. Let me try to explain—possibly in the process I will manage to put my tumbling mind to rest.

For as long as I can recall, old photographs have fascinated me. To page slowly through collections of historical pictures, no matter what the theme, was consummate joy. Even when I was quite a small boy I used them as my time machine into the past. They took me up and away from the problems every youngster has while growing up, and let me wonder of people and places long since returned to dust. Matthew Brady's Civil War photos had a particularly strong attraction for me, with the horror (and yes, I will admit it, the *fascination*) of war frozen in the images of young men dead before life had really begun. To look at the fallen youth of more than a century before, and to wonder who they were, what they had felt and thought—it all sent shivers through my romantic mind.

I suppose I might have become a professional photographer. But somewhere along in the process of looking at pictures, I became aware of the miracle of the *technology* of picture taking. That led me to chemistry and optics, and finally by some wonderous route, I became an electrical engineer. I never lost my love for old pictures,

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though, but merely turned my interest in them to the photographic history of electrical physics.

To search out and acquire (for by now I had started my own collection) a photograph of Steinmetz, smoldering cigar clamped in his mouth, giving a lecture on AC circuit analysis using the then still mysterious square root of minus one made my heart beat faster. To find a faded picture of Einstein at a long forgotten conference, caught forever in time with his quiet, gentle eyes looking into mine, would send me to the heights of ecstasy.

But it was Maxwell that led me to my incredible discovery. There is no doubt but that James Maxwell was the greatest theoretical physicist of the nineteenth century. Together with Einstein, he was the best of *any* century. Could it possibly be more than mere chance that the *same* year saw the death of one and the birth of the other? It was Maxwell who gathered together all the then known, but fragmented, experimental bits and pieces of knowledge about electricity and magnetism, and stirred in his own contribution of the displacement current. There was no physical evidence then to justify that last step, but the genius of Maxwell knew it *had* to be. And then, from his soaring mathematical insight and physical intuition, he took it all and wrote down the four magnificent equations for the electromagnetic field!

No one who has seen and understood those beautiful equations can come away without a quickening of the pulse and a flush of the blood. They're not long—you can write all four vector differential equations on the back of a postcard, but oh, what they tell us! With them, Maxwell showed light was electrical in nature, predicted radio waves *two decades* before Hertz discovered them in the lab, explained energy propagation in space, and radiation pressure, and laid the scientific basis for today's television, radar, lasers, giant electric motors, generators, transmission lines, and—well, why go on? The equations are the work of a level of genius we may not see again for a millennium. We have hardly begun to discover the marvels wrapped inside the electromagnetic field equations. With their aid, and that of quantum mechanics, the very secret of life, itself, may someday be unraveled.

And so I searched for old photographs of Maxwell. He died at his family's Scottish home in 1879, before the art of picture taking was barely forty years old. But I knew in my heart that somewhere there *must* be photographs, yet undiscovered, of such a great man. Anyone who seen the best examples of prints from wet-glass collodion negatives knows they are, in the faithfulness of their rendition of detail, better than what we commonly expect today. Working against me was the fact that the process was slow, laborious, and unforgiving of mistakes. The taking of a picture was not a minor decision in Maxwell's time. But still I searched.

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I searched for one photo, in particular. When Einstein died, a famous picture was taken of his office, just the way he left it for the last time. On the blackboard behind his desk are the last thoughts he had in his long quest for the Unified Field Theory. The writing on the papers covering the desk is clearly legible, and with modern blow-up methods, easily readable.

At the time of his death, Maxwell was the Einstein of his times. Surely, I reasoned, a similar photograph of Maxwell's study must have been taken. Even though none has come down through the decades to us, it *must* exist! Gathering dust in an old attic trunk, or buried in a long forgotten album, it had to be somewhere. I vowed to find it.

I began by writing to all of Maxwell's living descendants, asking that they search through family holdings for any pictures concerning Maxwell that they might possess. For the most part all were cooperative, even though more than just a few thought I was somewhat deranged. Still, it was in vain. I did receive a few old pictures never before seen by other than the family, including a poignant one taken in 1901, showing Maxwell's grave in Parton Churchyard at Glenlair, Scotland. A forlorn, wintry scene, with only what seemed to be three men in the far distance, it brought tears to my eyes. Alas, there were no photos of Maxwell's study.

But then late last year, while on a business trip to London, I stopped off for a few hours at the historical archives maintained by the British Institute of Electrical Engineers. On a chance, I looked through their massive files on Maxwell and was rewarded within the hour! What I found will haunt me throughout the remainder of my life.

There it was, stuck through its border with a rusty pin, between two pieces of yellowed paper covered with what appeared to be some simple, rough lecture notes. An ordinary looking photo of a study. Obviously overlooked through the years, or at best unappreciated for what it was, it was the almost illegible, penciled notation on the back that convinced me of my find—just a date: November 9, 1879. Exactly four days after Maxwell's death, precisely when some unknown, yet inspired person (a family member, a neighbor, a local scientist?) would take such a picture!

I am ashamed to admit it, but there was no hope the Institute would let me have the picture. And there was no time to copy it, for I was to return home to America that very night. No, no that's not true. The *real* reason for what I did was simply that I *had* to have that original, *old* photo. I took it! It was my undoing, for that dishonorable act destroyed the picture's tie to verified, legitimate historical records. But *I* know what I found is true.

I could barely control my wild emotions on the flight home. Several times I removed the picture from my brief-

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case, and looked with fascination at the papers lying on Maxwell's desk, and at the tightly written lines of mathematics on the blackboard in the background. My hands trembled with what can only be called lust—once home, reunited with my well-equipped photo lab, I would learn every secret hidden in that picture.

There are no words I know that can convey the thrill I felt as I began the processing of that priceless photo. Alone in my lab, with all the modern equipment a well-off amateur can buy (a Caesar Saltzman 8x10 enlarger with mercury vapor point light source and a 10x Plane Achromat Nikon enlarging lens), I carefully cropped and blewup selected views of the blackboard and desk. Printing the enlargements on ultra-fine grain AGFA Brovira paper, I could scarcely restrain myself from peering at them with a magnifying glass while I waited for them to dry.

Then, at last, I had them spread out across my study desk. I tried to force myself to examine each slowly, carefully, in turn, and not to skip from one to another like a child let loose in a candy store with a dollar. The first three were of the desk papers, including what seemed to be a diary. It must have been lost after Maxwell's death since no trace of it exists in the historical records. I experienced a stunning thrill as I gazed upon the scrawled words, but as they were not easily read at once, I moved on. It was the sixth blowup, of the upper right corner of the blackboard, that sent me reeling back into my chair. An equation that shouldn't, no, *couldn't*, be there. But it was.

To understand my reaction, there is one astounding thing you must realize about Maxwell's field equations. When Einstein turned the world of physics on its head in 1905 with his famous paper, "On the Electrodynamics of Moving Bodies," all the old ideas about absolute motion and simultaneity of events went out the window. Even Newton's laws of mechanics had to be modified. But *not* Maxwell's! His equations, just the way he published them in 1873, are the same ones studied today—they need *no* relativistic corrections.

How can that be, you wonder, as they predate Einstein's by thirty-two years? The mystery of this has bedeviled the experts down through the years. Oh, they have an explanation, alright. They say that all of electromagnetics is actually relativistic phenomena to begin with, and the laboratory work of Faraday, Ampere, Henry, and the other great experimentalists were studies of relativistic electron interactions in matter. Thus, it is only "natural" that Maxwell's equations need no correction. So goes the "expert" explanation, but it isn't right! I know Maxwell knew about relativity, and understood it perfectly. He knew all about time paradoxes, and the equivalence of mass and energy.

Because how else can you explain the equation visible in my enlargement: $E = mc^2$!

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Why, you must wonder (just as I did), didn't Maxwell publish this remarkable result: relativity theory? At first, I believed it was because of a lack of faith in his results. Who would have believed any of it in those Victorian times, so sure of its absolute view of nature? I thought of how Newton, two hundred years before Maxwell, had suffered from a similiar hesitancy when he wrote the *Principia*. There, when explaining his theory of gravitation, Newton did *not* employ his new invention of the calculus (which he *had used* to make his discoveries), but instead fell back on laborious arguments based on the accepted mathematics of algebra and geometry. Who would have believed him, otherwise?

But then I realized that couldn't be right. Maxwell was a strong man intellectually and he wouldn't have held back for fear of disbelief. No, it had to be that he discovered relativity and the mass-energy law just before his death, with no time to make his work known. I was still wrong.

It was later, when I returned to the enlargement of Maxwell's lost diary and read those painfully cramped notes, that I learned the truth. What I saw there showed me Maxwell had thought long and hard about his final discoveries, and had purposely withheld them. For clearly visible, after I had slowly deciphered the writing, were the following words:

I have seen monstrous events. My blood has run cold at the sight of two great cities leveled to the ground, their inhabitants cruelly put to death instantly, or left to die slowly from a strange, lingering disease. Other trips, further on, have shown me the root of all these evils is the mass-energy equation, a result I at first believed to be my crowning glory. It will be my crown of thorns unless I ban it from my very being. Another will discover it for himself, but my *soul shall be free! I have dismantled my machine, and shall never look upon or think of those horrible scenes again.*

This passage was dated just one month before Maxwell died a savage death from cancer. The reference to "two cities" can only be that of Hiroshima and Nagasaki. His own death was surely caused by lingering too long among their atomic ruins.

Think of what this *means*. Quite simply, Maxwell knew the secret of time travel! But even more incredible is that it must be *easy*, if one only knows how, to build a time machine! Think about it—Maxwell had no gigawatt power stations at his disposal, no high technology machine shops, or nanosecond computers. He was not a gifted experimentalist, and once he had predicted radio waves, for example, it took others twenty years to generate them. And yet, *he* built a time traveler. Somehow, with just the puny power sources available to him, and a limited mechanical capability, he wrested the *simple* implementation of a time machine from his dynamical field equations.

Yes, yes, I know what you must be

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thinking. How can I really conclude such an incredible thing from a single equation on a blackboard, and a few words written by a man dying a painful death? A man, clearly suffering dearly, possibly not in complete possession of his once marvelous mind.

This very evening the last bolt of evidence slid into place. Attempting to escape from the emotional maelstrom into which I had fallen, I turned to my old love of picture gazing. I took down from my library shelf a tattered (yet cherished) volume of the Meserve Collection of Lincoln pictures. My slow paging stopped when I came to the famous photograph by Alexander Gardner of Lincoln's second inauguration. This incredible picture shows John Wilkes Booth looking down on Lincoln from behind a buttress high on the steps of the Capitol, while below in the crowd are the five men who, forty-one days later, conspired with him in the assassination.

The following page demonstrated the extraordinary quality of Gardner's work, as it showed an enlargement of Booth's face in which the circular line between the pupil and the white of each eye is sharp and crisp! This impressive picture fascinated me, and I wondered if I could create a similiar enlargement. It was then I remembered the old picture of Maxwell's grave, sent to me from Scotland, and the three distant figures in the background. They would present my photo-lab skills with a challenge, and the effort would distract my mind.

I finished the enlargement just twenty minutes ago. Those faces! Two of them I can now finally accept as being there—it must have been a pilgrimage for one, and for the other, it couldn't have been anything but a mocking, ironic gesture. But I wonder if the youngest one really knew who his two companions were? I don't know the answer to that—yet. But there they are, two men with faces my years of study have made as familiar to me as my own. One is a youthful Albert Einstein. The other, with the signs of death clearly written across his features, is James Clerk Maxwell. The face of the third man is familiar, too, for the third man is me!

Oh, I'm a bit older in the photo than I am now. But it's me, alright. A peculiar, jagged scar across the left cheek, a mark from a childhood accident, is sharply visible, and I can run my finger over my face and match it perfectly with the image in the enlargement. I'd say I'm about forty-five or so in it, no more than ten years older than I am now. That doesn't leave me much time to keep my appointment, does it? I don't know, right now, how I'm going to do it, but I've got to rediscover Maxwell's secret of time travel. I'm sure I'll succeed—after all, there I am in the picture. Somehow, I'll be going back to pick James and Albert up so we can have our picture taken. Ten years—not much time.

I'm really looking forward to meeting my two new friends from across time. ■

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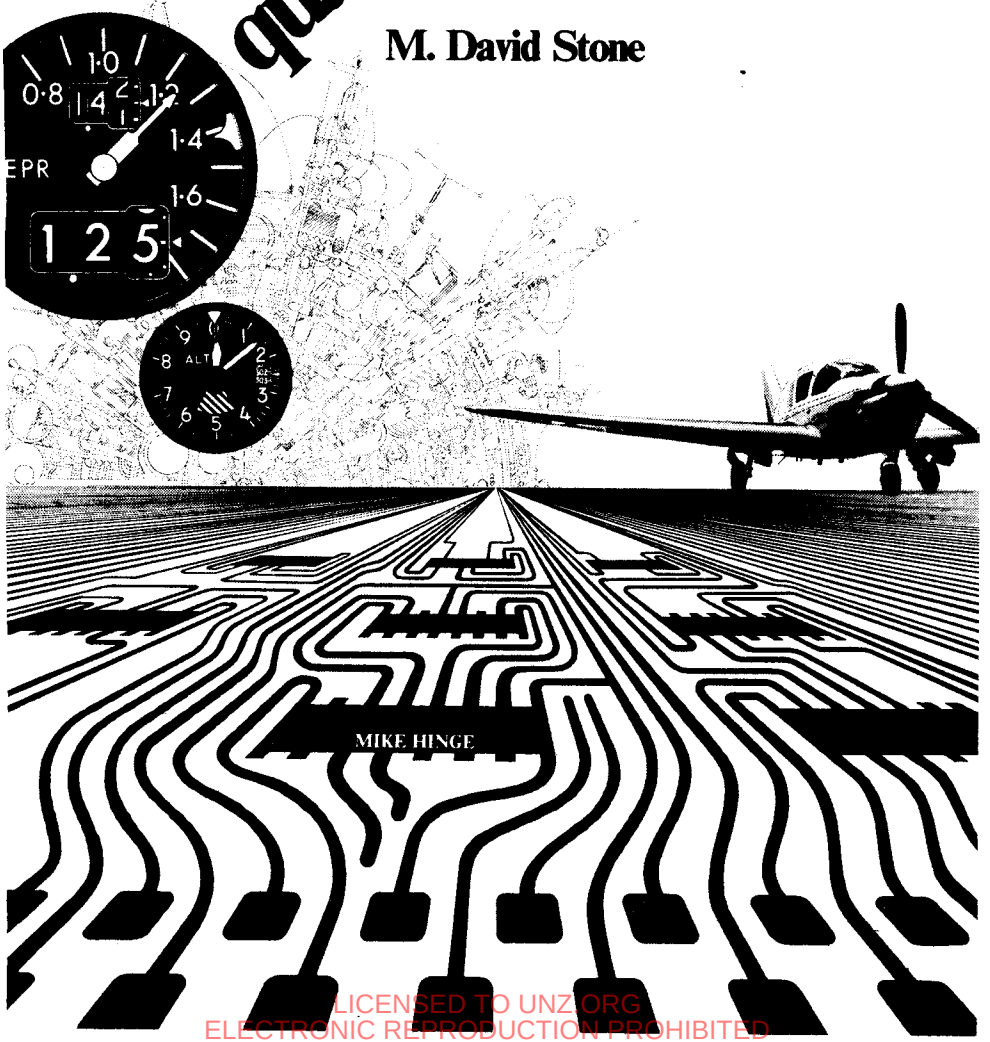
New knowledge comes from scientists. But it takes a politician to put new knowledge to use.

quantum jump

M. David Stone



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The plane was waiting at Kennedy. It was exactly what I had expected—an Air Force version of a commercial jet—except it was decked out with special seating arrangements, tables, phones, and a steward or two.

I was standing just inside the entrance, taking it all in, when I heard John's voice behind me.

"Good morning, Mike."

I turned. John was seated in one of three swivel chairs that were grouped around a table. He was looking up at me from under his thinning brown hair, his head raised just a notch from straight and level. He looked unhappy.

"Morning," I said. I sat next to him and tested the chair. It was anchored firmly to the floor. "Been waiting long?"

"No. The minute they woke me up I told them to bring you also."

"Thanks." Was John developing a sense of humor?

The plane started taxiing. A steward came over and made sure that our seat belts were on and that our chairs were locked so they wouldn't swivel on take-off. He disappeared into another section of the plane.

"This whole plane seems to be just for us," I said.

"And our retinue of Secret Service agents."

I turned and looked at the five of them. Two had brought me here; the other three, presumably, had brought John. They were sitting as far from us as they could manage and still be in the same section of the plane. Were they respecting our privacy? Or were they recording everything we said?

I turned back to John. "They tell you where they're taking us?"

John shrugged. "He's in Colorado."

"Oh." I nodded absently, then looked over the plane again. "Hey, you don't think this is . . . uh . . ." I indicated the plane with my hand.

John was already nodding. "It is. Air Force One—or one of them anyway—minus the Presidential decorations."

Well how about that. Who would have thought that Mrs. Harrison's youngest son, Michael, would ever take a trip on a Presidential jet?

Of course the jet wasn't for me really; it was for John—Dr. Johnathan Hoffer, respected theoretical physicist, popular-media scientist, sometimes science advisor to President Herbert Dowd, et cetera, et cetera.

John was famous—almost legendary among physicists—for two talents. One was a profound intuitive understanding of the mathematics of probabilities, an incredible asset to a theoretical physicist who dealt with quantum theory. Einstein had had that kind of understanding, but he'd refused to accept quantum theory, so he'd never applied himself to it. John had.

His second talent was an uncanny ability to work his way through tortuous paths when necessary to reach his conclusions. And he always came up with the right answer to the problem. At least according to his reputation he

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always came up with the right answer. The fact that we were on this particular plane at 6 A.M. on this particular morning—the day after the press conference—meant that something had already gone wrong with his plan.

"John, do you think we've lost our chance?"

He gave me a funny look. "I hope not." His eyes stayed on me a hair too long before shifting to focus over my shoulder. I shook my head, trying to clear the image of him *looking* at me. I wondered at it, chalked it up to nerves—his, not mine—then turned to look out the window.

A little later, as the plane was leaving the runway, he closed his eyes. "Let's try to get some sleep," he said.

Sure. Good idea. An even better idea would have been not to get involved with John's hairbrained scheme in the first place, but it was a bit too late for that.

You see, Mr. President, I'm just an innocent PR man. I didn't know what I was getting into.

No, the scene wouldn't play well. Besides, I had gotten into this because John had convinced me he was right, and I still believed it. That didn't mean I had to be happy about it though.

The plane banked, pushing me against my chair and bringing the Manhattan skyline into view through the window. Usually the sky looks dirty, with the buildings lost far in the distance, but this morning, after a night of rain, it looked freshscrubbed. The rising sun was just high enough to glint off skyscraping towers that looked like brilliant jeweled imitations of the real thing.

The plane went into a cloud and the window went blank. I seriously considered the possibility that I had just had my last view of New York for a long time.

Six months ago, on the night that John had told me about the Jumper and asked for my help in "sneaking it past the defense department," I'd made the mistake of asking if he had considered what would happen if his plan didn't work.

"You mean if they find out what we're trying to do?"

"Umhum."

"With any luck we won't get shot for treason."

From anyone else I would have assumed that was a joke, but John had never before displayed a sense of humor, and to the best of my knowledge no one had ever accused him of having one.

"Great. Any back up plans?"

"I haven't thought of any yet."

The conversation had haunted me ever since. We had mailed some letters the morning of the press conference as a sort of backup, but still . . .

I turned from the window and closed my eyes.

Well, the letters were still in the mail. That should insure the Jumper would be out in the open.

I hoped I would be also.

Four sleepless hours later, three in the plane and one in a car, John and I

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arrived at a house in the mountains where Dowd was staying with "an old friend," as such people are usually called. About thirty seconds after that we were ushered into a study decorated in a sort of ersatz mountain cabin style. Dowd was sitting behind the bulky oak desk: he stood and came around to greet us.

My first reaction to seeing Dowd was shock of recognition—in spite of the fact that I had fully expected to see him. I guess on some level I hadn't really believed it. He looked just like he does in the holocasts (well, how would you expect him to look) except that his image is always a little fuzzy—as images tend to be—and here he was, solid, with sharp edges.

He was a big man, bigger than I had realized, with that extra smoothness of motion that made him appear somehow larger than life.

A glance at his face showed me why I had been roused at five thirty; he'd been up for much longer than that.

"Hello, John."

"Hello, Mr. President."

He turned to me.

"You must be Mike Harrison." He extended his hand.

"Yes, Sir."

"Sit down." He indicated two chairs.

"Mr. Harrison, you're here with John because when my men went to pick him up this morning he said we would want to see you also." So John hadn't been joking. He must have particularly wanted me along, but why? Was he afraid he couldn't manage a situation that needed on the spot thinking?

"What little hurried research we could get done during the night indicates that you are the only other officer in this corporation uh . . ." he looked down at something on his desk, "Intercity Transport. I gather you are intimately familiar with this 'Jumper' device and with John's plans—whatever they are." The last was growled as an afterthought. "Is that right?"

"That's about it, Mr. President." I tried swallowing and found I couldn't.

"Fine." He turned away, dismissing me, but not entirely. "John, what the hell's going on here?"

" 'Going on', Mr. President?"

"Now look," he wasn't angry, not quite, "I've had a long night and, if I may quote Churchill, this is the sort of nonsense up with which I shall not put." He pointed a thumb in my direction, "He can call me 'Mr. President' and take advantage of my good nature. You can't; we've known each other too long. I want some straight answers from you, and I want them now, so call me 'Herb' and answer my questions."

I looked back and forth from John to Dowd. How about that! I knew this president was known for his informality, but I never dreamed that John knew him that well.

"Of course . . . Herb. What exactly is it that you want to know?"

"Don't play with me, John." There was an edge to his voice that I, at least, was taking seriously. Why did I get involved with this insanity in the first

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place? There was a part of me that wanted to inch over to John and tell him to tell the man what he wanted to know.

"I assume you've seen the news reports; I also assume you know that we are initiating business as a messenger service. There's really nothing else to tell."

"Really." It was the most chilling reading of a single word that I had ever heard. Dowd picked up a pencil by its point and started tapping the eraser on the desk.

"Why don't you start by telling me how a matter transmitter works."

"I don't know that I can."

"Try."

"Well . . . Okay. To begin with, it's not a matter transmitter, exactly, in the sense that it doesn't *transmit* matter."

"What does that mean? You put something in here and you take it out there, right?"

"Yes."

"Then it's a matter transmitter."

John shrugged. "I guess it has the same effect, but it's not really . . ." He trailed off under Dowd's withering gaze. "It's called a Quantum Jumper because it takes advantage of quantum mechanics. Mike is the one who came up with the name, actually. I wanted to call it the 'Probability Amplifier'." Dowd's face reflected a clear lack of interest in the name.

"Uh . . . Well . . . the classical theory of quantum mechanics says, in part, that there is an inherent uncertainty in the position of an object. In fact, one interpretation insists that if none of us is looking at that desk, for instance, its p-wave—sorry, that's probability wave—spreads out over the entire universe and only collapses to 'here' when a conscious mind interacts with it. And when it does interact, 'here' may turn out to be somewhere else. Of course with anything as large as that desk, the odds of finding it somewhere else are very slight, but the probability is there nonetheless. Now, this aspect of quantum theory, the uncertainty or probability aspect, is something which some physicists could never really accept, and it's something which I've never felt comfortable with.

"Those of us who felt that way used to talk about something we called the 'Hidden Variable Theory'. The idea was that there's another level below quantum mechanics that's as deterministic as any nineteenth century conception of a clockwork universe. Well, I've found that hidden variable. I've found a way to manipulate it and a way to amplify the effect so it can apply to macroscopic objects—like the key rings and coins and notebooks I demonstrated with yesterday afternoon."

There was a glazed look in Dowd's eyes that indicated he wasn't following John's explanation.

"In essence, what I've found is a way to decrease the probability that an object is located in a particular place to nearly zero, but then the probability of its presence at any other particular spot in the universe increases only

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infinitesimally.

"But I've also found a second effect—a way to increase the probability that the object is located at some other particular spot to near certainty. So the object ceases to be in spot A and instead exists in spot B. Or at least it does most of the time; sometimes it doesn't work and that's what makes the Jumper dangerous for people."

John stopped. The silence was punctuated only by Dowd's pencil tapping. Finally he put the pencil down.

"General Zeilik is from intelligence." Dowd indicated the General with a subtle nod of his head. I hadn't noticed him before. He was sitting in a corner, no doubt practicing the ninja art of invisibility. Now that I saw him, I was greatly impressed by the tailoring of his uniform; it almost hid the fact that he was overweight. "Would you like to hear what he thinks of your Jumper?"

John shrugged. Dowd took it as a yes.

"Tell him, General." Dowd perched his tail on the corner of the desk.

Zeilik stood and started to pace, counting his points off on his fingers.

He spoke quietly, lecturing to some imagined class on a case study in data interpretation.

"What we have here are a number of facts which, if taken at face value, don't fit together.

"First, we have a theoretical physicist with an important international reputation who hasn't made a single contribution to physics in almost four years. No papers, no letters to journals, not even a comment on someone else's work. Or is there something I don't know about?"

"No," John said, "I've been rather occupied with this, but that doesn't mean anything."

"Right.

"Second, that physicist, who has previously shown no interest whatsoever in business, suddenly decides to go out and start his own business." He paused again and looked at John, who did something between a shrug and a nod.

"Third, the device on which that business is going to be based is a radically new invention by that physicist." Pause. Nod.

"Fourth, that invention is *so* radically new that the physicist doesn't even bother patenting it." *He's done a thorough job in one night*, I thought.

"We didn't want premature publicity," I said. Zeilik didn't acknowledge it. His attention was fixed firmly on John.

"Fifth, because he is a theoretical rather than an experimental physicist, it would seem that he came up with the theory first and then went on to build the device." Pause. No response.

"Sixth, the device itself, not to mention the theory behind it, is a fantastic achievement, probably worth a Nobel Prize to that physicist, yet he doesn't so much as drop hints to his colleagues or otherwise try to establish priority in any way until the day he presents it, a full-blown working device, at a press conference." Pause.

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"I said we didn't want premature publicity."

Zeilik turned to me as if he were seeing me for the first time and didn't like what he saw.

"Seventh, that physicist brings in a public relations man who, according to his former boss, is very good at what he does." His eyes were doing a good imitation of laser beams drilling through me. I tried to look relaxed, but somehow I felt he hadn't said that as a compliment. "That public relations man proceeds to hold a press conference which stresses all the things that the product can't do."

Our friend the General was really sharp. "What's your point?"

"Don't press conferences usually praise the product to the high heavens?"

"Yes. So what?" It was the best I could come up with.

"I'll come back to that." I decided I was definitely playing in the wrong league. "Number eight," he turned back to John, "the physicist uses this incredible device to establish, of all things, a messenger service." He looked away from John and towards his imaginary class. His voice dropped in volume and took on a sarcastic tone. "A tiny little messenger service that goes to four lousy cities and can't possibly earn any real money because the only businesses it will compete with are minimal operations."

John sucked in some air—a panic reaction. Zeilik didn't notice because he wasn't looking, but Dowd did and cocked his head. I looked back and forth from Dowd to John. I didn't have time to puzzle it out. Zeilik had paused again, but he was apparently ready to continue all day point by point.

Well, John had brought me along for my ability to think on my feet; it was time to earn my keep.

"We plan to start small and grow fast," I said.

"Obviously."

"General Zeilik," I said in a tone of voice that translated as I'm-a-tolerant-man-but-there's-only-so-much-I-will-put-up-with, "so far everything you've pointed out has a simple reason behind it. I don't understand what you're getting at."

"You're right. Each anomaly does have a simple explanation. But taken together, they don't add up that way. They form a pattern."

"Look, this is all very interesting, but where is it leading? Are you accusing us of something?"

"I was about to tell you where it's leading. As to your other question, yes, I am accusing you of something." He waited a beat. "Treason."

It was no more than we had expected, but the single word still hit me like a piece of ice lodged somewhere in my chest. I don't think I flinched, quite.

"I haven't gotten to you yet." I didn't like the sound of that either. Maybe I should have kept my mouth shut. "From what I've been able to piece together during the night, Mr. Harrison, you seem to be no more than a slick public relations man who's

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latched on to a good thing—or what he thinks is a good thing." He smiled at me without showing his teeth.

"You're thinking in stereotypes, General." I said it as nicely as I could, trying to match his earlier tone. It stopped him for a moment. I caught sight of Dowd over Zeilik's shoulder; this time he was looking at me, and he looked thoughtful.

Zeilik shrugged. "Perhaps, Mr. Harrison. If so, I'm sorry."

I raised an eyebrow, a trick I'd learned when I was very young by practicing in front of a mirror. If I could just push him off balance—make him a hair unsure—then maybe I could do something brilliant. If I could think of something brilliant to do.

He drew himself up before speaking again.

"What I am suggesting—or what the facts suggest—is that Dr. Hoffer's device is capable of doing quite a bit more than he claims it can. I suspect that it can do everything he claims it can't."

So much for the last flickering hope for plan A; we hadn't even begun to sneak it by them. And we still didn't have a plan B. Of course we did have the letters, but it wasn't time yet to tell them that.

"That's ridiculous," I said, "you don't have the slightest evidence for it."

"It'll be easy enough to find out if I'm right. Would you care to arrange a test for us?"

We locked eyes. He shrugged and looked away, then continued in an almost offhand manner.

"I suggest that when Dr. Hoffer first stumbled across the hint that led him down this particular theoretical byway, he knew immediately where it would lead and knew that we would want to oversee it. I suggest he decided, with the best of intentions of course, that the military couldn't be trusted and that for some higher good, science perhaps, or humanity, he had to bypass us and make his invention public. Finally, I suggest that you joined him for your own reasons, and one of you thought of this idea as an innocuous way to go public.

"But it didn't work."

"Assuming that you're right."

"Assuming that I'm right." He nodded his head toward me, a minor point conceded. "As to the treason part . . . let us, for the sake of argument assume that I am right."

"For the sake of argument," I said.

"Fine. Now you haven't broken any laws, but it's evident that you purposely sidestepped the military. It wouldn't be too hard to make life very difficult for the both of you. On the other hand, it isn't necessary to do that if you agree to go along with us and cooperate like good citizens."

"What I suggest is setting the episode up to look like a hoax. Then we close the company, slap a Top Secret—Eyes Only designation on the project and develop it from there. Unfortunately, it will hurt your reputations—Dr. Hoffer's more than yours I suspect—but those will be restored

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when the truth eventually comes out."

Some dispassionate corner of my mind analyzed Zeilik's proposal and admitted it made good sense. From his point of view.

"It's an interesting theory," I said.

Zeilik shrugged an acknowledgement.

Dowd stood and walked to his chair. He sighed, then spoke in a tone that was more-in-sorrow-than-in-anger. "You see where that leaves me, John. The General's analysis works. As he points out, it'll be easy enough to—how should I say it?—arrange for a private demonstration. I think I already know what we'll find though." He waited for some response. It was time to tell them about the letters.

"You'll find that you can't do what the General wants in any case," I said.

"Oh?" It was the sound of a man totally in control of the situation.

"About twenty-four hours ago we mailed out some preprints of a paper explaining the theory behind the Jumper. I know you'll have to try to track them down, but you really shouldn't bother; they have no return addresses on them and should be spread throughout the postal system by now. They were mailed to a very select group of unselect physicists."

Zeilik reached into one of his briefcases and held something up.

"You mean these letters? I'm afraid you've forgotten how efficient a computerized mail service can be." He sounded almost apologetic.

I felt an empty feeling in my stomach as I realized they were going to take the Jumper. And then, for the first time since I had been wakened that morning, I felt calm, but it was the calm that comes from a knowledge of sure defeat. Something inside insisted I keep up a front.

"Isn't tampering with the mail a crime anymore?"

"National security."

"Of course," *bastard*. "How many do you have?"

"Fifty-three."

Every single one. "You're missing quite a few."

"No we're not." He didn't have the slightest doubt.

Silence. A big block of silence. I saw John looking at me like he was waiting for me to say something. Unfortunately I didn't have anything else to say. The unreality of the situation finally hit me. Here I was, a PR man of no particular importance, sitting in a room with the President of the United States, an old college friend who happened to be an extremely important physicist, and a general who was much too good at his job.

At least they weren't thinking of putting us in jail, though that was a small enough consolation; if John was right they were about to make a decision that would lead to the war that would really end all wars.

The military mind. Damn.

I found myself staring at Dowd. He was seated behind the desk, looking thoughtful. Hmm. Dowd wasn't a mil-

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itary man. And there was something about his tone of voice . . .

"Mr. President," I said, trying to look and sound calm, "we've heard the General's recommendation: are you planning to follow it?"

And I realized I *wasn't* calm anymore. Somewhere in the back of my mind was an idea. The pieces were there, but they wouldn't come together. I've felt that way before, staring at a chessboard, knowing my subconscious had found a brilliant move and would let me in on it soon.

"That depends. John, will you tell me what you have in mind?"

John didn't have anything to say. This wasn't supposed to have happened. We were supposed to have been an established business before they got this far.

I could try the truth. John had said they wouldn't listen, but I could try it.

"Mr. President, General Zeilik's analysis is essentially correct, but we did this for a reason. John has extrapolated that when the Russians find out we have the Jumper they'll be forced to launch a preemptive attack before it can be deployed."

"I thought it was something like that." Dowd shook his head. "No. We can keep it a secret." Exactly what John had told me they would say. But he had also said that the Russians would find out. "It's inevitable," he had said.

Where was that idea?

"Now wait a minute. They already know about it." True, but not what I was looking for. I kept thinking . . .

"What?" Zeilik tensed.

"You figured all this out on the basis of a news report. Do you think their intelligence service is any less capable than ours?"

He visibly relaxed. "Oh. We've already taken that into account. They will receive reports from 'reliable sources' that the hoax story is correct."

And you're going to bet your life on that. Everyone's life.

I looked down and saw I was clenching my fists; I hadn't felt the fingers digging into my palms until that instant. *I'm so close. I can almost reach out and touch it.* A thread of the thought filtered through my mind. *Quantum Jumper. That's it, but what?* It was gone. I was trying too hard.

I willed my hands to relax.

Silence, then Dowd shook his head—reluctantly I thought.

"All right. That appears to be it then." He had made his decision; we were being dismissed.

"But you can't do that," I sputtered, desperate, buying some time, hoping for a random thought or word to help the idea crystalize.

Zeilik interrupted me with a snort. I glared at him. "There'll be rumors. People will know."

"Just as there are rumors about the tablet you drop in water to make fuel, and about tires that don't wear out, and about perpetual motion machines," Zeilik said.

Checkmate? Where was that bril-

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liant move. Was I just kidding myself?

"But those things are impossible," John said, "this isn't."

Dowd and Zeilik were both looking at John, pointedly not saying it.

This looked impossible also.

I looked from John to Dowd to Zeilik. For no apparent reason I remembered a discussion I'd once had with John fifteen years ago about the history of physics being a series of statements asserting, then proving, the plainly impossible: there was Copernicus saying the Earth moved; and there was Galileo saying he could see things through his telescope; and there was Einstein saying space and time were variables . . .

And it all fell into place.

I laughed and became the center of attention.

"Don't you see? This looks like the same category as perpetual motion to you and me because we're not physicists. But it's not." I spoke directly to Dowd, ignoring Zeilik entirely. "Do you know what the two fundamental cornerstones of modern physics are?"

He shrugged. "Relativity is one, I suppose."

"Right. The other is quantum mechanics. The same quantum mechanics that John was talking about before. Do you know what it is?"

Dowd cleared his throat, not sure I wanted an answer. He fidgeted just a bit. "Not really."

"Let me try a few phrases from high school physics. Have you heard of wavicles? Waves that behave like particles? Particles that behave like waves? The Heisenberg Uncertainty Principle? Probability waves? Does any of that sound familiar?"

He shrugged again. "I've heard the terms. John mentioned probability waves before."

"Do you know what a black hole is?"

"Something with such strong gravity that light can't escape."

"Good. How about a quantum black hole?" I hoped I had my terminology right; it had been a long time since college—since "Physics for Poets" and explanations from John. Dowd shook his head. "Your definition of a black hole was perfectly fine," I said in my best schoolmaster voice. I didn't dare to look to John for confirmation. Even if I was wrong I had to sound smugly sure of myself. "Light can't escape; in fact, nothing can escape. But in small black holes, quantum mechanics takes over.

"Particles can't escape a black hole because the wall of the gravity well is too high. But they can *tunnel through* it. Do you know what that means?" Dowd shook his head again. "It means they get from here to there without traveling through the space in between." No reaction; he wasn't following me. That left me uneasy, because I wasn't sure of my facts. But at least I had the spirit of the thing right. I hoped.

I took a deep breath and plunged on while I still had the momentum. "Have you heard of a tunnel diode?"

"I've heard the term."

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"Do you know what it is?"

"No."

"It's a common device in which electrons," was it electrons?—oh well, no matter, "tunnel their way from here to there without traversing the space in between. Quantum mechanics again." I stopped and took the time to look around. John was allowing himself a hint of a smile. That was all the confirmation I needed. Zeilik was beginning to look worried. Dowd sat calm and impassive. I decided I'd hate to play poker with that man, then realized that was exactly what I was doing.

"Do you see what I'm saying? All John's device does is amplify the quantum mechanical effects. You and I would think it's easy to make the Jumper sound like a hoax because we don't know any better. But some physicist on the other side might begin to wonder—no matter how convincing your 'hoax' story is—particularly with John's name attached to the idea. And if he started playing around with the idea . . ." I shrugged and leaned back in my chair. For the moment I was content to watch Dowd drum his fingers on the desk.

After considering for a while he looked to Zeilik.

"General?"

"It seems to make sense, Mr. President. I'll have to check with a physicist to know for sure."

"We have a physicist right here; why don't you ask him."

Zeilik raised his eyebrows at me. "Under the circumstances, I hardly think we could take his word for it."

"What would we have to gain by lying? Particularly since I'm sure you're going to double check it anyway."

"He has a point, General." Dowd briefly rested his elbows on the desk and his eyes on his fingertips. "Well, John?" He looked up.

"He's perfectly right; I should have thought of it myself."

Dowd considered some more. "What you're saying is that I'm in a no-win situation. If I let you go ahead the way you've planned, the other side finds out about the device from your successful business; if I stop you, they figure it out anyway. Is that about it?"

I nodded. It was his move.

"Mr. President, I still suggest we go ahead with our original plan. If we make this whole thing look like a hoax it'll take them longer to reinvent the Jumper."

I stood up. "No, General, you haven't thought that out." I interlaced my fingers and stretched my arms out in front of me, cracking my knuckles. Zeilik was looking at me as though I were a bug he'd found on his dinner plate, but it didn't bother me. "You see, General, if you close us down today, tomorrow someone's going to begin to wonder what John had and start working on the problem. But let me set up an intelligence problem for you.

"You're on the other side. You find out that an American scientist has announced the Jumper. Then you find

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out that the U.S. Army, naturally curious, stepped in to investigate, but quickly left, feeling there was no military potential. What do you conclude? Particularly when you find out that ITI, having been awarded a nice fat NASA contract to jump small items to the space stations, is planning to expand and will be setting up offices in various cities, including Moscow and Peking?" I was talking to Zeilik, but I was watching Dowd.

"Planning to what!" That was Zeilik, sounding like he couldn't decide whether to laugh or get angry. Dowd's eyes just widened a bit.

"Answer his question, General."

Zeilik looked up at the ceiling and disappeared into a fog. Some inner computer went to work as he considered the question. He took some papers from his briefcase—presumably checking a few facts—and did a lot of frowning.

For the next five minutes the two loudest sounds in the room were the soft rustling of turning pages and the thumping of my heart. But not in that order. I kept wishing I was as sure of myself as I had tried to sound.

"As an intelligence officer I'd file it away as an interesting but militarily unimportant scientific development." He didn't look happy about it.

I looked to Dowd. "I think it's your decision, Mr. President."

"Wait." Zeilik again. "I said, 'as an intelligence officer'. What about a scientist? And what are you going to do with this thing? You can't keep its capabilities a secret forever. As soon as anyone else starts fooling around with it they'll find out."

I wasn't ready for that one. John was.

"As a scientist, without anything to go on, you would wait expectantly for me to publish the theory behind the Jumper."

"Great." He let his open hand fall against the arm of his chair. "That brings us right back to letting the world know what the Jumper can do and how it does it."

"Not really. The theory is sufficiently difficult and hazy so I can obfuscate the facts and lead people in some wrong directions—for quite a while I suspect. Those letters in your briefcase contain a very subtle mistake which will translate into a very unreliable device. In fact, I only found my way to the correct theory by making a mistake and not noticing it—something on the order of what Linus Pauling did when he concluded that DNA was a triple helix, about the equivalent of adding two and two and getting five. Only this time the 'mistake' was right and accepted theory was wrong. No one else is likely to do the same thing again, particularly with me leading them in wrong directions.

"But that's not the point." He waved it all away. "The point is that to the extent that the jumper has military potential, you can keep it exclusively ours longest by letting ITI continue the way we originally planned it. And that's the decision which has to be made now."

"He's right," Dowd said. "What I

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need to know is whether what they've said is right—that business about quantum mechanics. And I need to know it right now."

It was an unmistakable dismissal. The General acknowledged it by grudgingly picking up his hat and starting toward the door. I watched it close behind him. That's when I realized it was all over but the official decision. We'd done it—we'd gotten by the military.

Only . . . I still have this problem. Problems.

"The two of you are—uh—invited to stay here until the General returns."

"Of course," John said.

"There's one thing I want to know though. What's this really about?"

"About?" John said, fairly radiating innocence.

"I was watching you while Zeilik was talking; you had a strong reaction when he pointed out that you'd be competing only with businesses that have minimal operations. Why react strongly to that? It didn't make sense. Still doesn't unless there's something else to this that I don't know about."

Ridiculous idea, I thought, *of course there's nothing else*. But I'd seen that reaction also.

John nodded his head slowly. "Okay, Herb, I might as well tell you now as later." *Tell him what*?

"Have you considered during this long night just how much of the economy and the work force is directly dependent on transportation in one way or another?"

Dowd considered. So did I. When it hit me, it was all at once.

I heard a choking sound and realized it was coming from my own throat.

If I could have, if it were possible, I would have been out of my seat collecting the words and pushing them back into John's mouth. As it was, I simply sat in place, stunned. What was the phrase?—snatching defeat from the jaws of victory. *Didn't John realize that we could still lose*? This man was a politician, and that meant he was responsive to minor political pressures. Bad enough that John had never told me what was really on his mind, but now, a little too tired, or a little too trusting perhaps, he had gone ahead and told Dowd. *Damn*.

The answer to John's question is that better than half the economy *and* workforce is directly dependent on transportation. No? Here's a partial list; add it up: truckers, bus drivers, mechanics, gas station attendants—hell, the entire transportation industry and most of the oil industry. That's airlines, steamship lines, the highway construction industry, and the automotive industry. Remember what happens to the economy when GM goes on strike for a couple of months? What happens when it goes out of business altogether?

The list goes on. Endlessly it seems. Sure, ITI would offset part of it. Sure, auto-factory workers would be replaced by ITI factory workers. But without a new model each year and without planned obsolescence there

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would be less being built. The result? Fewer jobs. And sure, auto mechanics would be replaced by ITI technicians. But tell me, when was the last time your household computer broke down? Your radio? Or your phone—not the phone line, the instrument itself? How about your car?

Get the point? Dowd did. About the same time I did. He closed his eyes and took a deep breath.

"Good God, Man. You want to let *that* loose on the world?"

"It's not a choice. If we don't do it someone else will eventually. At least we know enough to look out for the consequences."

"How?" It was the first time Dowd had raised his voice.

"I have some ideas."

"I can still stop you." He sounded like he was planning to do just that.

"No you can't. The same logic applies as before. Only more so."

"But you said no one else was likely to make the same mistake you did."

"Not likely to, but someone will eventually. You can trust me on this; you're dealing with my strong points, extrapolation and probabilities. No one is likely to make the same mistake I did in any given day or week or month, the chances are too slim, but add enough months together and the occurrence approaches certainty. It will happen."

Dowd considered that. Once again, so did I.

John apparently thought he had Dowd backed into a corner. I wasn't so sure about that.

In the long run John was right of course, but politicians don't operate in that time frame. What matters to them is the next election. Had John taken that into account? He had some curious blind spots—like wanting to call the Jumper a "probability amplifier." I'd finally argued him out of that (*John, it's simply not wise to hand the opposition such an obvious joke. "It'll probably work, but on the other hand . . .*") but what scared me was that there *were* occasions when his brilliance seemed to desert him. This might be one of those times. Or did he know Dowd well enough to be sure of what he would do?

"You only have one choice, Herb. Society is going to have to make a quantum jump of its own. You're

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going to help it along. You have to."

For a long moment Dowd teetered on the edge. I could see the conflict in his face, but could only guess at what was going on in his head. What was it? Political instincts versus a desire to be judged well by history? Statesman versus politician?

Finally he nodded.

"Okay, John." All at once he looked very tired. "Tell me, just where is society headed and how do we get there?"

"We'll talk later. I have a plan of sorts."

"Hm. I hope it's better than the one that was supposed to keep the military from interfering with you."

"Why do you say that? They're not going to interfere, are they?"

Dowd shook his head—in unbelief?—then stood up. "If you two will excuse me, I'm going to make believe I didn't get an answer to my question and I'm going to try to get some sleep. He walked to the door, then stopped and turned around. He pointed toward the desk. "If you push that white button someone will come in and get you some food or show you to your rooms.

"Good morning." He left.

John stood and started to the desk.

"Wait."

"Hmm?" His hand stopped, poised in the air, halfway to the button.

"John, why didn't you tell me about this economic aspect before? And what did you mean by that last crack?"

"Last crack?"

"The one that went, 'Why do you say that? They're not going to interfere.' "

"Oh, that." He drew his hand back and shrugged. "Well the plan worked, didn't it? You're the one who came up with the solution. The military is forced to keep its hands off, we get a NASA contract and plenty of money to expand with, and as a bonus Dowd is maneuvered into a position where he has to help us. What more do you want? As for the other—I was waiting for you to figure it out for yourself." His hand started towards the button again.

The light began to dawn.

"Why you Machiavellian son of a bitch. The hell you were waiting for me to figure it out. You planned it this way. You kept me too busy with details to give me a chance to think about implications, and then you let me lull myself into accepting the conclusions that you, the master of extrapolation, had presented to me," I said accusingly.

He pulled his hand back from the desk and scratched behind his ear.

"Something like that."

Another piece clicked into place. "Damn. You never had any intention of slipping it by them, did you?"

"Well, not really." Reluctant. Like getting a small boy into the bathtub. "Yesterday, while you were worrying that they might catch on and come after us, I was worrying that they might not."

"But why didn't you tell me? And why make me sweat like that if you

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already knew how to bludgeon him into doing what you wanted?"

He looked embarrased.

"Well . . ."

He let his hand drop to his side, then cleared his throat. "I didn't exactly have the bludgeon as you so delicately call it."

"Huh?"

He fidgeted a little, then cleared his throat again.

"Remember the night I asked you to help?"

"Sure."

"I said you were good at thinking on your feet and that I was going to need that."

"Right."

"Well . . . it wasn't a general statement; I had something specific in mind—I had today in mind." He had the good grace to look even more embarrassed.

"What?" I said, feeling the beginnings of a sinking sensation somewhere deep in my stomach.

"I had to have Dowd helping, but I couldn't see how to manage it. You see, there were several logical attacks to the problem—different arguments that made sense—but convincing him had less to do with a logical presentation than it did with reading his personality and finding an approach that would get through to him. I extrapolated that if there were any way at all, you'd come up with it—if you were under enough pressure. The probability was really quite high.

"I've always said you have a first rate mind. You do. I'm very good at dealing with ideas, if I'm given enough time. You're very good at dealing with people. And you work best under pressure; I've seen it. I simply arranged things so I could use your abilities to the best possible advantage. For both of us."

I gulped. "But why didn't you tell me?" It came out as a hoarse whisper. "If I had known, I would have walked in here knowing what to say."

"No. You wouldn't have. You needed the pressure, and you needed it to be spontaneous. You knew this confrontation was a possibility all along, but you didn't come up with the answer until you had to. If you had known you would have to come up with something, you would have been worrying about it for six months, you still wouldn't have had an answer, and to cap it off, you would have been stale. And tell me this: would you have gone along with me without a plant—without knowing exactly how you were going to persuade Dowd?"

"Probably not."

"That's why I didn't tell you."

I chewed on all this for a while and decided I couldn't swallow it. John was a master of extrapolation, but this . . .

"John, you're joking, right?"

No answer.

"John?"

He pushed the white button.

"Sure."

All of which brings me to the other problem; I didn't think of it until later, but no one has ever accused John of having a sense of humor. ■

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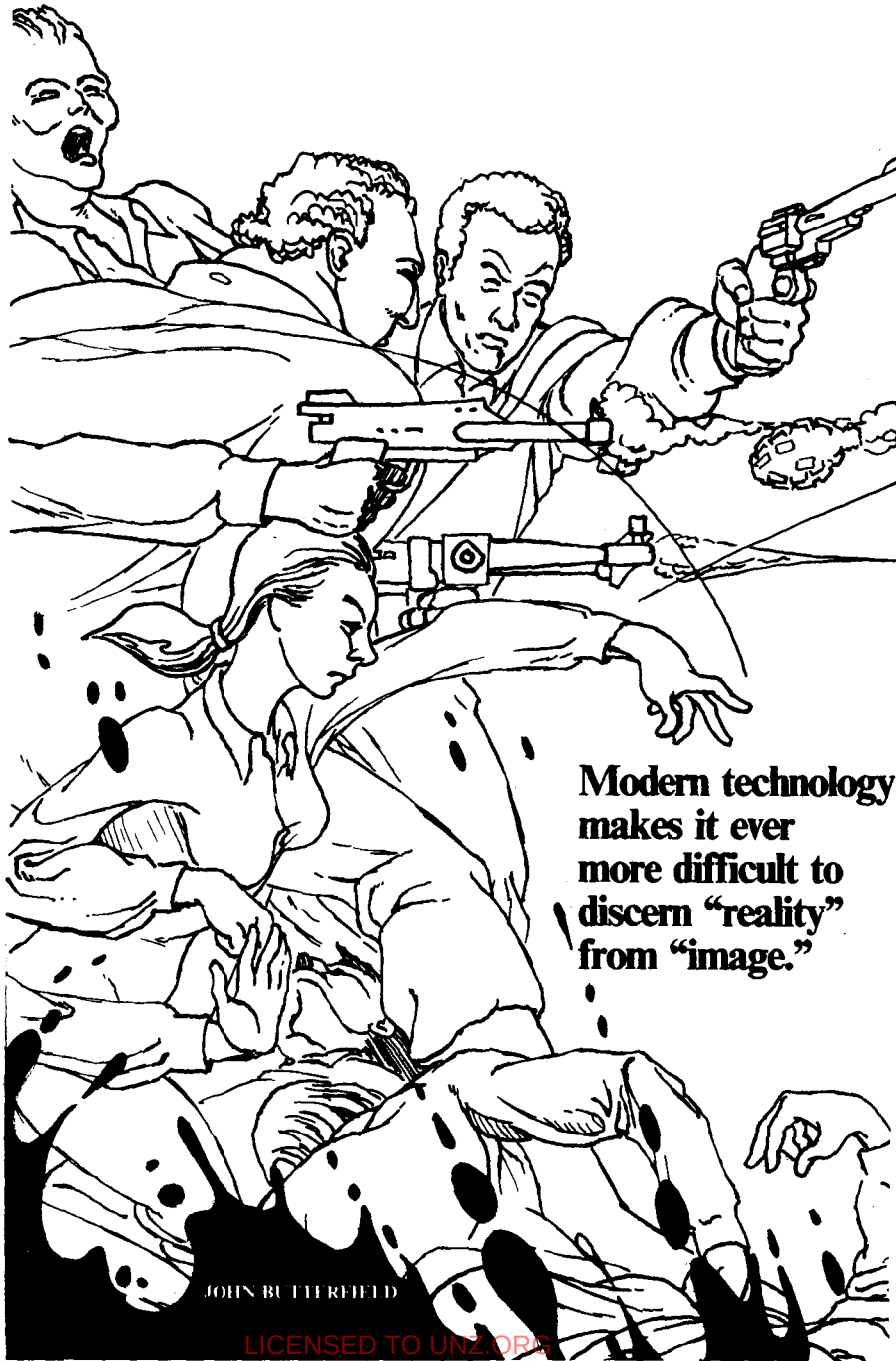

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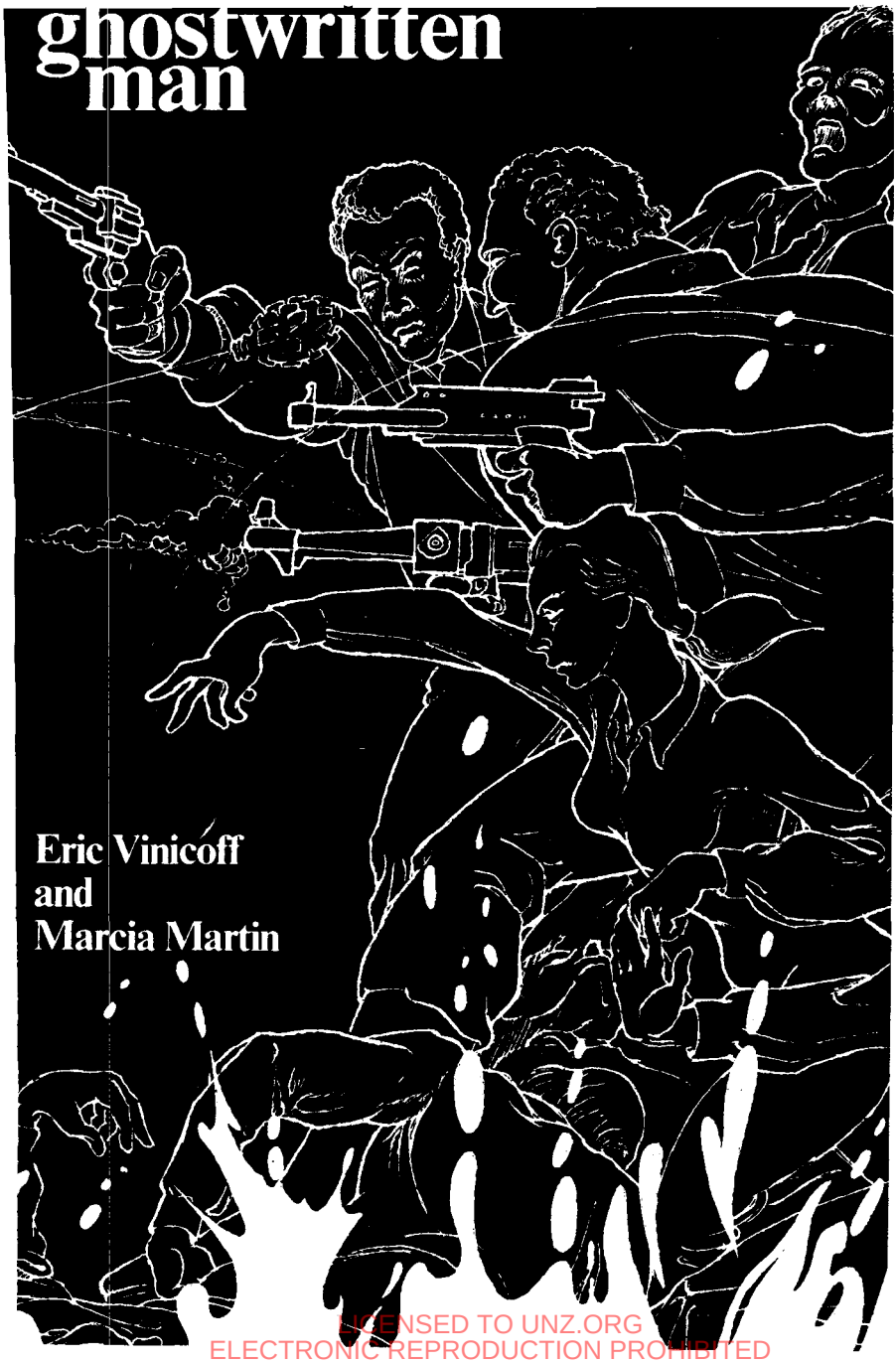
ghostwritten man



Eric Vinicoff
and
Marcia Martin

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It began for Dick Swann with the shot, and a great twisting surge of disaster.

Night on the White House grounds. President Nivling liked to stroll through the gardens to think out hard problems, and with as little company as possible. Dick had objected many times, personally and through channels, to no avail. But that was no excuse now.

The sharp crack of a big bore rifle—undoubtedly starlight scope-equipped—drifted away.

The Man, large and thoughtful the moment before, went slack. Pale. And began to slide to the ground.

Where was he hit! No way to tell in the dark.

Stabbing the beeper in his pocket, Dick fell on top of the still figure.

Alarms whooped, and the searchlights flared. Questioning shouts approached.

The second shot tore into his left arm and through. Shock put a numbing cap on the hot pain. He didn't think it had hit bone, and anyway it had missed the Man.

Soldiers appeared. A dozen formed a wall around the President. Dick shouted, "Sniper! South fence!" Other soldiers rushed in that direction.

There were no more shots.

Medics rolled Dick aside and went to work on the President, except one who tied a rough bandage on his arm and gave him an injection.

He stood up, staggering beyond the cordon, sick from something much worse than his wound.

The fence section swung down for the onrushing soldiers. They vanished into the street and the slums beyond.

Seconds later there were M–16 bursts. The sniper rifle responded. More bursts. Then a shout of triumph.

The medics, with the President on a stretcher, retreated with the cordon toward the nearest White House entrance. It yawned yellow, swallowed them, then closed.

Dick was alone.

He knew he needed medical aid—shock and the stimulant wouldn't keep him on his feet much longer. But he had to know something else.

Who?

The soldiers returned, one carrying a small body slung over his shoulder. Another carried the big rifle—a 7.62 Mannlicher.

Dick gestured for the soldiers to detour by him on the way to the guardhouse. The alarms had died. The fence rose back into place, but men in suits—Secret Service, he knew bitterly—were beating the bounds for more trouble.

The assassin was dead. A burst had taken away most of both legs. What remained was dressed in a black jumpsuit. But all he wanted to see was the face.

He grabbed the bun of blond hair under the black beret, and lifted the head.

He could see the charcoal-blackened face.

Nancy O'Brien.

Disgust ate at him. The face was

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one of the two hundred plus every Secret Service agent had to memorize. And watch for. But the latest reports had her in Belfast.

How in hell—!

Why was obvious.

The soldiers went on their way. Dick turned to follow the medics.

He had to find out if the Man was still alive.

He took three steps, then the world folded him into darkness.

Three days in a private room at Walter Reed Military Hospital had almost driven Dick crazy. After the first flurry of debriefing, he had been put on ice. No TV or radio. No phone. No chatter from the doctors and nurses.

The treatment fit in well with his mood. He had committed the one unpardonable crime of his profession, saved from ultimate disaster by nothing more than luck. The hearing would clear him of actual negligence, of course, but there would undoubtedly be reassignment to a 'safe' desk job. And the whispered words would follow him.

The door opened, and Nick Chin entered.

The head of the Secret Service wore a friendly grin, as always, but Dick wasn't fooled. Behind it lay a mind used to thinking all sorts of unpleasant thoughts.

"Morning, Dick. How are you feeling?"

"The limb is fine. How's the Man?"

"Okay. By the way, to the outside world the assassination attempt never happened. The President is resting at Camp David in preparation for the peace conference, not three floors up."

Gears began to turn behind Dick's forehead. "How'd you manage that?"

"Everyone involved has been sworn to secrecy. The commotion was explained as a typical juvenile-over-the-fence stunt."

"Which leaves why?"

"You're slowing down in here. Come on—get dressed. The doctors have released you."

Dick was glad to get out. Still, he didn't like this scenario because he didn't understand it. As he dressed he asked, "What now?"

"You're wanted upstairs."

Dick followed him through gleaming corridors to an elevator, worried. His dour expression could mean someone had pulled rank. Three floors up . . .?

It couldn't be.

But it was.

He ushered Dick past Secret Service guards into a private room. There, flat on his back and connected to intensive-care equipment, was President Nivling. "Hi, Dick."

Dick smiled tentatively. "I'm glad to see you're alive, sir, and looking well."

"And I thank you. Mister Chin seems to think you were somehow remiss, but I disagree. Even he admits your actions appear to have been technically correct."

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The President forced a slight smile. "I've been listening to the latest updates on the Irish situation. And reflecting on my actions. Beneath all the other problems is one of trust. After the many decades of killing the two sides are incapable of trusting each other. I've tried to bridge the gap. The peace plan is merely a diagram, a piece of paper; I'm reaching out to both sides as a neutral peacemaker."

He paused for breath, then went on. "It's working. We're closer to a true settlement than at any time since partition. The conference is the key. If I can keep the IRA, PPA and government leaders at the same table, dealing with each other, it can work. But I'm the only one they all trust; the conference was my idea. I have to be there, or it'll blow up."

He stared unhappily at his sheet-covered body. "Only I can't be there. The doctors won't let me out of here for at least a month. The conference is scheduled to begin in ten days; the situation won't hold together that long without me. I *have* to be there."

Dick managed to dredge up a bit more guilt. "Isn't there anything you can do, sir?"

"No. But there is something *you* can do. For me. For the people of Northern Ireland."

"I beg your pardon?"

Nick Chin stepped forward. "We have a plan. A bit bizarre, and extremely risky. If it goes wrong, you'll be responsible for causing the U.S. great embarrassment. But it might succeed. You never know."

"The goal is worth the risk." President Nivling smiled. "I'm sure you can make it work."

GHOSTWRITER, INC.

The faded sign was attached to the door of an office. The office was located in a rundown building in Scranton, Pennsylvania; far from the high rents of the Big Apple, but close enough to land the assignments from Madison Avenue and Avenue of the Americas.

Dick stared at the sign for a moment, thinking out the scenario. The pair who were the whole company had been security cleared, and the premises covertly checked for bugs. He had been through the hastily compiled dossiers on them at least five times.

Thinking of Mellis, he sighed. Now for the hard part.

He opened the door and went in.

The business office was a disaster area. Neither partner specialized in secretarial or janitorial work. Since no one was on duty there, he pressed on into the work room.

Take a small computer room. Not the sparkling, air-conditioned kind IBM maintains, but a relic with equipment five years out of date, dirty and much-jerryrigged. Decorate with Big Mac cartons and plastic cups. Build a library around it. Then stir well with a cyclone of habitual bad housekeeping.

Two people were slouched in chairs, staring up at him. "Hi," said Cynthia DeWitt, Ph.D. in cybernetics. "You're Mister Swann?"

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Dick nodded. She was in her middle thirties, and good looking even in the I-don't-give-a-damn lab jumpsuit. Her attitude was wary.

Harv Mellis, evicted from MIT for 'antisocial behavior' and mainly self-educated, was downright hostile. "So take a dive. Cyn thinks we should hear you out, but I'm not so generous. We've got work to do."

Harv was only slightly below average height, but wore a Napoleon complex of a two foot dwarf. "What makes you think I'm not a legitimate client?" Dick asked.

"To put it in words you can comprehend, because we're not fools! We've been doing this for nine years—we invented the filking field! And for nine years you creeps have been trying to rip off our energy!"

"What he means," Cynthia slid in smoothly, "is that, although the techniques of computer ghostwriting are common knowledge among the dozen or so firms that practice it, the fine points of programming authenticity are an art. We're the best because we've been at it longer, and because Harv is a genius at synthesizing software techniques and literature."

Harv fell at her feet, took her hand and kissed it. "You flatter me enormously, my dear—and accurately." Turning to Dick he snarled, "Publishing's an incestuous little cosmos, and we've never heard of you! Go tell Hansen or whoever you work for that we didn't fall for your scam. Get out! Cyn and I are late for a bit of *ménage à trois* with the printer."

She sighed but didn't blush. Dick pulled out his wallet and flashed his Secret Service ID. "I'm Agent Swann, and this is official. Can we cut out the games and talk like adults?"

Harv jumped to his feet and stuck out his arms. "Sentinal of the status quo! Go on, cuff me and take me to your torture chamber! I won't fink on the Movement! I want my shyster!"

Cynthia pulled him back into his chair. "What do you want with us, Mister Swann?"

Dick shuddered slightly. "The lives and safety of a large number of people depend on you two, especially Mister Mellis."

"How so?" she asked. Harv was staring at him like something in a biology lab specimen bottle.

"I'll explain fully in a moment. But first, would you please run through your actual process. No secrets, of course, but so far I've only heard your, ah, profession described by others."

Cynthia launched into her sales pitch, but her heart wasn't in it. "The whole industry began about nine years ago, when Harv here, a very successful writer and computer hobbyist, figured out a way to satisfy the real and large demand for new literature from dead popular authors. Pastiches were a sad substitute for a new O'Neill play, Hemingway novel or a Ralph Ellison short story.

"Computer writing is hardly a new idea. But devising a program that would allow a computer to analyze an author's style, and duplicate it with precision, had to wait until both the

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hardware and software reached the necessary level of sophistication. And something else was needed; genius. The computer can handle style, but plot and theme require a computer/author teamup—inspiration from the human, analyzed author traits from the machine.

"We devised an equation for Style in the English language. It evolved from the work of reducing the whole of English syntax to an equation done in the late 70's. We use an algorithm for extracting the parameters of our style equation from a cross-sectional input of the author's works. We apply the inverse algorithm to a plot line, and the machine chunks out an essentially finished story. We check it over for consistency and logic—the computer doesn't know what it's saying. Then we sell the story."

"That's all you get for free," Harv cut in. "Now what's going down?"

"We need help." What Dick really needed was to bounce the creep off a few walls, but he restrained himself. He wasn't about to blow this for the Man. "We need a computer ghostwriter for a very important job, and the consensus of your competitors is that you're the best." And the hardest to deal with.

Had Harv really thrown an editor out a fifteenth story window into the Hudson River for making unauthorized text changes?

"What's in it for us?" Harv demanded.

"Your usual commission. Two weeks in exotic Ireland. And a chance to do something no one has ever done."

"Double our usual commission, did you say?"

Dick nodded.

"What exactly are we being hired to do?" Cynthia cut in.

"The computer impersonation of a human being."

Harv smiled. "You mean like slapping a wig and a Groucho mask on a 1620?"

"Very droll. We need to pull off a perfect impersonation of a prominent politician at a meeting with people who know him. Not only must his personal conduct be convincing, but he must negotiate with all the political charisma and skill of the original. We have a physical duplicate, an actor trained to the role. We need a script."

Harv began pacing and muttering. "Not a real script, of course. A response program based on continuous input. Can your trained ape take audio prompting through an earphone?"

"Yes. A subskin pickup is being surgically implanted now."

"Hmmm. To build up a computer simulacrum of your politico I'll need every scrap of data you can dig up on his personality, attitudes, style of speaking and mannerisms. Also a humongus computer—an Amdahl J195V7 should suffice. And time."

"You get carte blanche. Everything—except time. We only have eight days."

"The hell you say! Then get me a brace of programmers with ten fingers," Harry shouted.

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"Okay." He paused. "Do you think you can pull it off?"

Harve, mumbling to himself, ignored the question. But Cynthia said, "When he reaches this stage, it's looking pretty good."

Somehow the pacing little man failed to inspire confidence. Sighing, Dick opened his attaché case. "Let's get down to details, shall we?"

Dick slapped the offending clock radio, rose and went about his morning amenities. The Ulster Towers Hotel room was old, but elegant in a way no modern hotel could aspire to. Panelling, cornices and moulding showed the intricacy of hand work. The furnishings were Edwardian, and the tall windows looked down on Ormeau Park.

He lingered over his wardrobe a bit longer than usual, in anticipation of a special breakfast. On his way to the elevator he cheerfully greeted the police guards in the corridor. The black combat suits had been much in evidence the past week—Britain and Northern Ireland were determined to prevent any sabotage of the conference.

The Ballygally Lounge, off the lobby, was nearly empty at this early hour. Cynthia had already claimed a back booth.

"Morning," he said as he joined her.

"Top of the morning to you." She smiled. "You look tired."

He nodded. Being with her was the only bright spot in the grim sixteen hour days. Things were coming together. But would they be ready by zero hour? It was all so iffy, especially the part she knew nothing about.

"Plenty of time to sleep after this is over," he said. In public they talked around their work. Because of his inability to do likewise, Harv was sleeping in a room next to the computer center.

"Any special reason for asking me to join you here?" she asked after they ordered.

There was, of course. During the meal he would make a few carefully oblique comments as to the nature and importance of their job. All part of Nick Chin's web. But he said, "Companionship. It's been pleasant working with you and Harv."

"No one enjoys working with Harv."

"Okay, I was being polite. You."

She looked intently at her placemat. "I saw this coming. Romance in far places. Love snatched from the brink of danger."

He knew that tone from long experience. Oh well, it would have been nice. Nothing for it but to retreat as stylishly as possible. Tomorrow was another day. "I'll settle for breakfast conversation."

"Good."

He stared at her inward-turned expression. The dossier hadn't mentioned any current husband or lover. So . . . no. It wasn't possible. Was it?

"Harv?" he asked incredulously.

"Yes."

"But he's attacked every woman

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tech in the center! And he treats you like . . . like . . ."

"A friend. The only one he has. I liked and respected him when we were lovers. We aren't anymore—he found he needed a friend more. That's when I fell in love with him."

"Sounds bizarre."

"So people say. He needs me, to defend him from the world."

"And vice versa."

She smiled again. "He's a genius, and a perfectionist. He won't compromise on anything, especially his feelings. The world has no right to drag him down to its level."

He saw no reason to start a fight, so he steered the conversation into idle chatter about their Irish "vacation." The restaurant filled up, under the dour eyes of more police by the entrance. He delivered his prepared lines, then enjoyed his meal.

A police-chauffeured car picked them up outside the lobby. They rode in silence; Cynthia immersed in her own thoughts, Dick admiring the scenery. He had never been to Ireland before.

Belfast wasn't a particularly ancient or beautiful city, mainly a product of the 19th century industrial revolution. Dick recalled a writer named Robin Bryans describing the architectural style as "Victorian Grisly." But to his Washington-oriented eyes, as they passed the green-domed city hall and crossed Queens Bridge, it was charming and definitely old-world.

The furtive glances of the few citizens up and about told him as much as the many boarded-up buildings and heavy police/military presence. Capital of a land beseiged many years by fear. The tension of two sides in deadly conflict. A number of eyes noted the car's route and passengers.

Holding the conference in the midst of the problem was part of the President's plan. Admittedly it was a terrible risk. But it was also a vital symbol for success.

They could see Parliament House in the distance as they drove past the security perimeter surrounding the Hotel Stormont, site of the conference. Down a side street, around a corner, then a car pulled up before a truck entrance in a nondescript warehouse. The hotel tower jutted above the rooftops a short block away.

The chauffeur touched a button in the dash. The door rose out of the way, and the car eased into darkness. Behind it the door lowered with a clatter.

Dick climbed out and held the car door for Cynthia. Walking to another door at the end of the dimly-lit loading dock, they waited while hidden equipment scanned them. Finally the door clicked. They entered.

The army guards in the corridor wore suits for anonymity, but were from the U.S. Army's antiterrorist unit on temporary assignment to Dick's motly crew. As he and Cynthia strode to the corridor's end they were joined by Colonel Mason, the unit commander and Dick's liaison to the British/Northern Ireland security force for the conference.

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"Everything tight?" Dick asked.

"Drumlike."

"How about Harv?"

The colonel sighed. "He demands his Constitutional right to hit the pubs. Threatens mayhem if we don't cut him loose soon."

They came to the last door. Just as Dick reached for the knob it slammed open and a body flew out—Torgesun, one of their hideously expensive computer techs. Harv's shrill voice followed. ". . . and keep out! You couldn't find your way through a flip-flop with a roadmap and an Indian guide!"

"Madman!" Torgesun shrieked, and retreated down the corridor.

Dick looked pleadingly at Cynthia. She nodded, and pursued the tech to mollify him first, then Harv. It was getting to be her major duty.

Dick and the colonel entered the computer center. Hardware jammed almost every inch of it. Six techs and two programmers listened with various degrees of humor and irritation as Harv ranted.

"How's it going?" Dick interrupted cheerfully.

"Where did you round up this gang?" Harv muttered. "Is the circus in town?"

"What's your status?" Dick glued his cheerful expression in place.

"The President arrives this afternoon."

Harv shrugged. "That's a set speech. Not the same thing at all."

"But will it sound authentic!" Dick snapped. The Man was supposed to have written it himself, but with him now in a coma . . .

"Relax. I wrote the program personally. Best speech he ever made, I guarantee."

"Need any help?"

"Yeah. Quit wasting my time and let me get back to checking the data acquisition modules."

Dick followed the colonel to the far end of the center, bottling up the steam. The older man smiled. "Charming gentleman."

They paused at a console manned by an Army lieutenant. In the console's holovision tank they could see a tiny image of the center, a miniature reflection of the activity around them. "How's the shooting gallery progressing?" Dick asked.

"Smooth at our end." The colonel pointed up at the cameras and mikes in the four corners of the ceiling. "We're getting a sharp picture. In the gloom it should go over. Want to see?"

"Sure."

The colonel led him back to the loading dock, then through a second door. Another guarded corridor brought them to another door. They opened it and peeked in.

He could have sworn it was the center. Harv was being pacified by Cynthia while Torgesun waited impatiently. Around them the techs and programmers labored noisily over the computer gear. It was slightly darker than the real center, but Dick could barely make out another door at the far end of the room.

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"Beautiful," he murmured.

"But will it score or punt?" The colonel frowned. "It's a pretty crazy idea."

"Isn't all of this? The timing will be delicate, but it might work."

"How's it at your end?"

Dick smiled wryly. "Who knows. We try not to be too subtle or too obvious. But the word is out. That this place is the secret security headquarters for the conference, a soft underbelly with a bolt hole to the conference room itself. Considering the security strength everywhere else, they'll *have* to try here."

"So you and the President say. But you're cutting it very cute."

"True. But it has to be. *We* can't do the deed—that would shoot the conference to hell. But as I said the word is out. In certain pubs where the IRA has ears. And through the PPA leaks at police HQ. We've given them each a corridor of opportunity. As for the rest—we'll see."

"We surely will."

Three techs tended the humming consoles and spinning reels. Everyone else in the center, including a tense, silent Harv Mellis, hunched around a television screen.

It was a commercial broadcast of President Nivling arriving at Aldergrove Airport.

Dick stared at the Man, speaking with his usual confident style from the portable podium in the airport waiting area. It was eerily perfect. A part of him almost wondered if the Man hadn't healed miraculously and replaced the actor.

But he knew better. The finely crafted phrases were emanating from this very room.

"Any interference in the transmitting system?" he asked.

Cynthia looked up at him curiously. "With the neutrino system how could there be? We could be operating from Australia just as surely."

"Oh." It bugged him to be the only one in the center who didn't understand what was happening.

The Presidential image neared the conclusion of its speech.

"Finally, I know many of you see me as a meddling foreigner here to impose things upon you that you don't want. Please give me the opportunity to try to prove you wrong. *You* want peace. *You* want an end to the killing and fear. I'm here not as an overlord to compel peace. I'm here as a friend to help if I can. Like a referee at a football match, to see that mutually agreed-on rules are followed. God grant us all success."

The applause at the airport was echoed in the center, though for a different reason.

The hate began in the Protestant Reformation in the 16th century, when the native Gaelic-speaking Roman Catholics were largely dispossessed of their lands by Protestant English and Scot 'plantation' owners. Ireland was treated as a rebellious colony and forced to submit to British laws and overlords. After 1800, when

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Ireland became part of the United Kingdom, conditions began to improve. By the end of the 19th century there was serious discussion of home rule.

Through the early 1900s the Irish Republican Army waged a successful guerrilla war against the British in Ireland. Only in Ulster were they soundly defeated by the Protestant Orange Order, and British control maintained. The northern Protestants feared they would be subject to religious persecution if their counties became part of a predominantly Catholic country.

In a British compromise, the island was partitioned by the Government of Ireland Act of 1920. The Irish Republic, overwhelmingly Catholic, became an autonomous nation. Ulster—Northern Ireland—remained part of the United Kingdom, but received a measure of self-rule, with its own Parliament and government for dealing with domestic matters.

As the years passed the Catholic minority in Ulster suffered religious and economic persecution. A civil rights movement was launched in 1968. Soon after the IRA started a campaign of violence. English troops were brought in to augment the Ulster police. Terror spawned counter-terror; the Protestant People's Army. Bombings and assassinations turned Ulster into a nation at war with itself, destroying its social and economic base.

But the years of violence bred a different kind of reaction too. In 1976 two Irish women, Mairead Corrigan and Betty Williams, founded the peace movement. Though labelled by both extremes as traitors, the peace movement grew. It demanded a compromise fair to both sides, but above all an end to terrorism.

President Nivling may have been the focal point of trust, but it was the peace movement that drove both sides to the conference table.

Ten men and two women sat around the circular table. Two IRA leaders, three from lesser Catholic groups, two PPA representatives, an envoy from Prime Minister Summerby of Britain, a Northern Ireland government leader and representatives of both the Catholic and Anglican churches of Northern Ireland. They were grim, unhappy in the company, and wary.

The President confronted them with warmth and confidence. He was the one known factor to each of them; long years of patient spadework had seen to that. He would hold them together until other bonds formed.

Security was personally guaranteed by him. The room was empty of guards, but the walls were heavy with sensors and devices to quell any kind of disturbance. Moreover, a squad of American soldiers was only a few feet away.

"Welcome, friends," he said. The tension reached its peak. Recorders clicked on to keep the minutes of the meeting. (Their mikes were also carrying the events in the room to Harv Mellis' computer.)

The other delegates delivered greetings of their own.

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"Now that we've reached this precarious stage," the President went on, "the hard work begins. But none of us are going to get shillelaghed either." A few strained smiles.

"Let me begin by reminding all of us of the points of general principle we've agreed to in writing. The killing and other violence will stop. A constitutional convention will be held to add a bill of human rights to the laws of Northern Ireland. Prejudice will be purged from the laws and the institutions of Northern Ireland. Massive economic aid from the U.S. and Britain will increase the level of opportunity for *all* citizens here.

"The current British peacekeeping force will withdraw, to be replaced by a U.N. force drawn from noninvolved nations. The cost will be primarily borne by the U.S. and Britain. This force will supersede the police, which will be massively reorganized to reflect the attitudes of *all* Northern Irish citizens, purged of old hates and prejudices. Within a decade the peacekeeping force will gradually withdraw, returning enforcement of the laws to the newly constituted police."

"Lovely words," observed McCarthy of the IRA. "But it would take Saint Patrick himself to make them reality."

"We're only poor human beings," the President agreed. "But we can try. And if we try hard enough, we can succeed. We have six days to begin working out the details. Shall we roll up our sleeves and start?"

Start they did; the sweaty, tiring, angry work of political negotiation. Yelling. Sullen silence. Threats. Promises.

And inch by inch, grudging, painful progress.

Hour after hour.

Day after day.

There was still energy in the center, focused on the steady activity of the techs and Harv's prowling course around the equipment. But it was subdued from the first few hours. Everything was going smoothly, and the initial peak load couldn't sustain itself.

Except at the far corner console where Dick and Colonel Mason stood behind the seated lieutenant. The holovision tank held two split images; the loading dock entrance area of the street and a second such area on the opposite side of the warehouse. There tension was slowly growing.

"It'll have to be today's corridor of opportunity," Dick said for the ninth time. "Neither side can afford to let the conference gain momentum."

Colonel Mason checked his watch. "T minus two minutes."

"Are your men ready?"

"Of course."

The lieutenant cupped his earphoned ear. "Bait taken, sir!" he exclaimed. "The garbage truck reports being cut off at an intersection. A ten minute delay at least."

"I bet *someone* shows up on schedule," Dick muttered.

"Did the PPA bite too?" the colonel asked the lieutenant.

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"Looks like, sir. That police detachment we're expecting; some mysterious conflicting orders sent it to the wrong address."

Colonel Mason snatched up a mike from the console. "Attention Teams Blue and Green! Both parties are on! Reception committees stand by!"

The lieutenant's hands danced over the console. "Shooting gallery coming on line!"

Dick found his next few breaths very hard to take.

The colonel concentrated on his own earphone. What he heard seemed to please him.

A laundry truck approached the warehouse entrance in the holotank image. To Dick it looked like the one that had been picking up and delivering every day the past week. "Team Blue," the colonel said into the mike, "your guests are arriving a bit ahead of Team Green's. Slow them up."

The warehouse door clattered up. The truck eased inside, and the door closed behind it.

Two men in casual dress climbed out of the truck and went to the security door. Dick couldn't hear the discussion, but after a bit the unseen security officer was apparently convinced. The door came open to a pull by one of the men.

Meanwhile a police bus appeared in the other image, and the same ritual was carried out by a man in a police uniform.

Suddenly the laundry men pulled balls from their pockets and began tossing them. Explosions wracked the corridor beyond the door. Men and women boiled out of the back of the truck, forty at least, armed with automatic rifles and grenades. Pausing a moment for plaster and wood to stop falling, they plunged into the corridor.

Like a remake of a movie, the same scene played out in the other image. Thirty-plus ersatz police charged into a similar corridor only seconds behind the laundry group.

"Timing . . ." Dick whispered. The next few seconds would tell the tale.

"Shooting gallery green go," the lieutenant reported. His hands danced again, and both halves of the tank switched to corridor scenes.

Both forces were creeping through pitch blackness, clearing the paths ahead with grenades and gunfire. The holovision cameras were infrared, but the pictures were almost totally obscured by fumes.

The shocks were beginning to vibrate the floor of the center. The techs looked around nervously. "A bit of action downstairs," Dick admitted cheerfully. "Relax. We're handling it."

"Get back to your consoles!" Harv screamed. "Jackson, check your displays! We're losing a full second off our latency access time! LeGrange, make sure our power and cooling systems are mellow!"

The devil they knew outweighed the devil they didn't. Work resumed.

The tank revealed both forces at the thick metal doors of the shooting gal-

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lery. The colonel grinned in anticipation.

Both forces had plastique, which they trowelled out liberally, wired and detonated. Two doors blew inward. The corridor cameras also went *hors de combat*. The lieutenant switched to the shooting gallery cameras.

The IRA terrorists stormed into the room.

The PPA terrorists burst in from the opposite end.

It was the spookiest, ghastliest thing Dick had ever seen. Over seventy people in a large but definitely limited space, all flinging mayhem at phantasmagorical computer center activity. Rifles spat. Grenades flared. Smoke dimmed the already dark scene.

Dick winced as bullets and shrapnel tore at him and the others. It was almost too real. Yet their counterparts in the gallery continued to work or observe unhindered by the death engulfing them.

"Shields down!" Colonel Mason rapped into the mike.

The walls of the shooting gallery were concealed armor plate. Now two more sheets of alloy slid down, replacing the ruined doors. The trap was sealed.

Each side was confronted with no escape, a roomful of equipment and people they couldn't touch or kill, and another force spewing slaughter in their direction. They were intelligent men and women, but rushed and under extreme pressure. They made the understandable mistake of assuming the other force was in some way responsible for their predicament.

The butchery began.

A heavy fire-fight and no cover. Bodies were riven, blown apart, gouged open so that red poured forth like a carpet over the floor. Faces contorted in final screams that were even worse for their silence.

Dick could hardly bear watching, yet couldn't look away.

In short minutes it was over. The fighting died out. Three IRA terrorists were still on their feet, though all were wounded.

"Now what?" Dick asked.

"We wait a bit for the situation to stabilize, then go in and take them prisoner." The colonel's face was flushed.

But the survivors had other plans. They slapped plastique against a wall and set it off. It was the biggest blast of all, and the tank image died. Red lights erupted across the console. A faint alarm could be heard beyond the center.

"What's going on?" Dick demanded.

The colonel frowned. "Damn! They blew their way out of the gallery! They're loose in the building somewhere—this could get messy!"

Dick looked around nervously. The work was going smoothly, and none of the others seemed to have any idea what was happening. "What can we—"

The door blew open under the force of a grenade. The three IRA killers swarmed in. There was no hope left in their eyes, or thought; only hate. None

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spoke. Three M–16's rose to seek vengeance.

Everyone had whirled to face the doorway, and most had frozen with fear. But not all. Dick had instinctively drawn his .44 Magnum, and the colonel likewise had his own sidearm out. The lieutenant turned and dove away from the console.

Dick fired first. His hot load slammed into one terrorist's stomach, knocking him back into the corridor in a cloud of blood and tissue.

The other two rifles fired. One missed the lieutenant, but took out the console in a gaudy electrical display. The second hit Colonel Mason in the right shoulder. He spun off a wall and down.

Dick fired again, and a second terrorist dropped. Then a loud noise and a burning pain in his leg sent him sprawling. He looked up into a dark hole promising the end.

"HAIII YAAA!" Something flashily dressed, compact and screaming flew horizontally into the terrorist. The rifle deflected before it went off, and Dick felt a cold, cold breeze by his left ear. He looked around desperately for his own gun, but couldn't find it.

So he watched with amazement, and a bit of grim amusement, as Harv tore into the six-foot, heavyset killer. They rolled on the floor, and Harv, in some kind of berserker rage, was getting the better of it. Kicking, biting, gouging eyeballs and other organs; he was doing it all.

Seconds later soldiers and medics arrived. Dick let a medic put a bandage on his leg while the terrorists were dragged out. The colonel was taken away, but the medics said he would be okay. Harv climbed to his feet, and impelled the techs back to their duties with a few choice yells.

Now for the hardest part, Dick sighed. Limping over to Harv, he muttered sincerely, "Thanks."

The hero of the hour was trying to catch his breath while Cynthia fussed over him. "Creep with a gun," he gasped. "Bad combo."

"That was stupid!" Cynthia complained. "You could have been killed!"

"We were all cold meat if I didn't." He looked at her. "Including you. Couldn't have that—take too long to raise some younger, better looking lass to your present level of incompetence."

She straightened his tie so well that he turned red and gagged.

Dick shook his head.

Harv went on a rampage around the center, whipping the dazed techs back into efficient labor. The systems had disdained the difficulties of mere mortals by operating smoothly through it all.

"Need any help right now?" Dick asked.

"Yeah. Get the blowers on full—this shit is bad for the hardware." Dick sent a soldier off to comply.

A medic gave him a shot to keep him upright a little longer, then Cynthia joined him. "What *was* all this? Why did they want to kill us? Who were they?" She was trembling.

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Dick explained about the shooting gallery.

"But *why*? Who were they?"

"The extremists on both sides. The ones hooked on violence, unable to accept less than total victory. They would have torn the conference compromise apart."

The light dawned. "So you set a trap?"

He nodded, looking her in the eye. "We knew they would try to destroy the conference. We led them to a place where they could destroy each other instead. I'm sorry about the trouble up here—that definitely wasn't scheduled."

"But won't all this killing upset the conference too?"

"It isn't going to be publicized."

"But you can't keep it secret!"

"Totally, no. Rumors will leak out. But nothing will ever be officially confirmed. Privately the leaders on both sides will find it politically expedient to be rid of the extremists who were a bar to any reasonable settlement. They'll accept what happened as a sad necessity, the last of the terror killing itself."

She looked at him dubiously.

Dick entered the hospital room and smiled. "You're looking much better, sir."

The President was propped up in his bed. He put down the papers he had been reading. "Thank you. And thank you for bringing off the conference. I've been reading the reports. Promising. Very promising."

"A good start, sir."

"And we'll nurse it along. My doppleganger is at Camp David, 'resting'. I'll join him in a few days. Next month, when I return to Northern Ireland to help with the implementation, there will only be one of me."

"Will you be well enough, sir?"

A bleakness shot through the older man. "I'll have to be. Our identity game mustn't come to light. It would destroy the trust that's the backbone of the Irish compromise, and lessen confidence in the office of the Presidency. Have you taken the necessary steps?"

"Yes, sir. Everyone is sworn to secrecy. Since we selected trustworthy people, and will keep tabs on them, that should suffice. Even Mister Mellis understands that publicity might bring IRA and PPA revenge down on him and Cynthia. And if word should somehow leak, there's no tangible evidence around anymore to support it."

"Good." The President smiled. "By the way, I had a talk with Nick Chin about your job. You'll be coming to Ireland with me. Hope you don't mind resuming the dull routine?"

"Thank you, sir. The duller the better."

Dick stared down at the worn old man who was going to drive himself near death to help a foreign people. Why? Megalomania? Messiah complex?

The President read the question in his eyes. "Your Mister Mellis and I are two of a kind. When we take on a job, we like to do it well." ■

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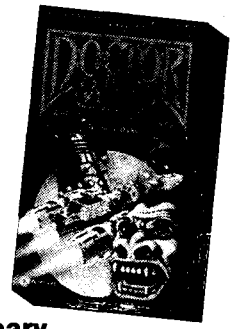

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war and space

Space is already militarized!

Charles Duelfer

Lately, greater public attention has been focused on the activities of the American and Soviet armed forces in space. This has resulted from both a growth in these activities and increased attention by the media. Highlighting this was the incident last winter when the nuclear-powered Cosmos 954 satellite reentered over Canada. This event in particular brought sudden widespread surprise, concern (if not condemnation), and questioning about military space activities.

This article will discuss and try to place in perspective the current directions of military space utilization, space weapons development, space defense, and finally, the potential for space arms control agreements.

First, however, a point should be made concerning why the American press (and presumably, the American public) reacted with surprise and dismay over the "militarization" of space revealed by the Cosmos 954 incident. These military activities should, in fact, surprise no one. Societies that compete and conflict on Earth are not likely to change as they extend themselves into space. As man expands into space he will carry with him the characteristic flaws which plague him on Earth. Still, the American public tends to view military use of space as a form of pollution. Besides the characteristic naive idealism some attribute to the American public, another reason for this reaction lies in the history of United States space activities.

Public attitudes toward the use of space were generally shaped in the sixties by the highly visible NASA programs, particularly the televised manned "space shots." These activities dominated the world press and to many, they were the beginning and

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end of United States space programs. The optimism and idealism of exploring this new frontier were as unbounded as space itself.

Yet, at the same time (and in the long run more importantly), the United States Department of Defense was also vigorously pursuing the prospects offered by the space environment. A series of classified defense programs were born in the early sixties and unlike NASA space programs, they have never ceased growing (neither has the shroud of secrecy been lifted). This division between open civilian and closed military space programs was a conscious political decision made to allow the maximum visibility for many of the accomplishments of the United States in space. In this, it succeeded. However, as the perceived importance of a subject is a function of the amount of coverage devoted to it in the news media, the balance of attention was weighted on the peaceful scientific uses of space. These projects need not concern themselves with threats to their survival other than those posed by nature. Therefore, realistic concerns over space conflict received little visibility, and in the United States, an attitude that space was a sanctuary from earthly conflicts was assumed. This attitude was reinforced by the signing of the United Nations treaties on the uses of outer space. These agreements will be discussed later. Suffice to say now that they are very limited in scope.

MILITARY SPACE TRENDS

To date, the military utilization of space has been primarily to monitor and command forces *on Earth*. This includes programs for overhead recon-

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naissance, communications, navigation, weather, and geodesy.

However, two trends are changing and expanding the role of military activities in space. The first is the increasing dependence of terrestial military forces (and indeed the economy in general) on space assets. For example, capabilities provided by communications satellites and early warning satellites have become irreplaceable by Earth-based systems.

The second trend is the increasing amount of assets being stationed in space. Currently, the Department of Defense alone averages about one billion dollars worth of spacecraft in orbit at any given moment. This is a lot of valuable hardware and concern about protecting it is only natural. The consequence of these trends is that the orientation of military activities in space is shifting to include programs for monitoring and executing force *in space* as well as on Earth.

Of course these developments have their counterparts in the Soviet Union. However, it is critically important to recognize that Soviet space programs have never been mirror images of United States programs, either civilian or military. In fact, they have been far different.

Organizationally, the Soviet Union has never distinguished between its military and civilian space programs as the United States has. The Soviet missions have all been conducted by the Strategic Rocket Forces of the Soviet Army.[1] This difference between the conduct of Soviet and American space programs may be part of the reason why space tended to be viewed as a sanctuary in the United States more than seems to be the case in the Soviet Union.

In the future, the division between military and civilian United States space programs will narrow. This is partly because it is not the most efficient way of conducting space programs and partly because of the necessity of using a common transportation system, i.e. the space shuttle.

CURRENT MILITARY SPACE PROGRAMS

The secrecy surrounding on-going military space programs has limited data available to the public, particularly data concerning Soviet systems. However, through careful analysis of the limited information available, much has been inferred (and later confirmed). It should be noted that virtually all the data on Soviet military space activities in the open literature is based on the efforts of Geoffrey Perry, Senior Science Master at Kettering Grammer School in Great Britain. For years, he and his students have monitored Soviet launches and generated a good picture of Soviet programs.

Information on United States military space programs is regularly reported in such industry publications as *Aviation Week and Space Technology* and *Aerospace Daily*. Such information is generally regarded as reliable.

The broad characteristics of currently identified military space pro-

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TABLE I
SUMMARY OF OPERATIONAL SOVIET MILITARY SPACE SYSTEMS

			Approximate Orbital Parameters			
Name	*Function*	*Number of Satellites Maintained in Orbit*	*Inclination**	*Period*	*Perigee (Km)*	*Apogee (Km)*
Molniya	Communications	16	63-66	12 hrs.	600	40,000
Statsionar (Raduga)	Communications	11 (eventually; 4 at present)	0	24 hrs.	39,000	39,000
Cosmos	Communications	24(?)	74	115 min.	1,400	1,400
Meteor	Weather	(?)	81.2	102 min.	850	900
Cosmos	Navigation	12	83	105 min.	950	1,000
Salyut	Manned Reconnaissance Station		51.6	90 min.	250 (varies)	350 (varies)
Cosmos	Photo Reconnaissance	approx. 30/ year	varies	varies	160 (varies)	210 (varies)
Cosmos	Electronic Intelligence (System I)	8	74	95 min.	550	550
Cosmos	Electronic Intelligence (System II)	2(?)	81	97 min.	600	600
Cosmos	Ocean Surveillance (System I)	2	65	90 min.	260	277
Cosmos	Ocean Surveillance (System II)	(?)	65	104 min.	900	1,000

**given in degrees*

grams for the Soviet Union and the United States are given in charts I and II respectively.[2] The functions listed are the primary ones observed. Recognition should be made of the possibility that other secondary missions may be carried on the same platform.

The number of satellites maintained on orbit is a best estimate of what constitutes the "full up" system. The individual spacecraft lifetime determines the actual number of launches per year. For instance, the Soviets usually have one reconnaissance satellite in orbit, but this requires about thirty launches per year because the vehicle has only a thirteen-day orbital life. This contrasts strongly with the United States reconnaissance system which appears to require only about three or four launches per year.

This difference in system designs to perform similar missions is exhibited in the other areas as well. Overall, the Soviet Union is reported to have had 78-81 military launches in 1977, while the United States is reported to have had only 12 military launches.[3] Stated generally, the Soviet systems are maintained by larger numbers of

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TABLE II

SUMMARY OF OPERATIONAL UNITED STATES MILITARY SPACE SYSTEMS

			Approximate Orbital Parameters			
Name	*Function*	*Number of Satellites Maintained on Orbit*	*Inclination**	*Period*	*Perigee (Km)*	*Apogee (Km)*
DSCS	Long haul Communications	4	0	24 hrs.	35,800	35,800
AFSATCOM	High priority communications with strategic forces via transponders on various "host" spacecraft	(?)	varies, depending on host satellite			
SDS	High priority communications link in polar region.	3	63.3	12 hrs.	300	39,000
FLTSATCOM	Navy fleet communications	4	0	24 hrs.	35,800	35,800
TRANSIT	Navy navigation	6	90	95 min.	350	1,000
DMSP	Real time and delayed weather data	2	90	101 min.	800	800
None	Navy ocean surveillance	4(?)	63.4	107 min.	1,100	1,100
DSP	Early warning	3	0	24 hrs.	35,800	35,800
"Big Bird" (unofficial)	High resolution photo reconnaissance	1	96	92 min.	150	250
None	Search and find photo reconnaissance, probably real time	1	110	89 min.	130	400
None	Electronic and communications intelligence	1	96	95 min.	500	500

**given in degrees*

smaller, less individually complex, and shorter-lived satellites than their United States counterparts.

Because so little information is available about how Soviet military space systems operate, only United States programs will be described further. It may be assumed, however, that Soviet systems perform equivalent missions by different methods.

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COMMUNICATIONS SATELLITES

The functions of satellites in United States military planning and operations are critical. The capabilities provided by satellites in command, control, and communications (C^3) make them vital nodal points. The direction of forces over long-haul distances as well as in regional tactical operations, depends highly on satellite communications links. Further, this dependence is growing rapidly. United States programs providing these links include:

FLTSATCOM—Along with leased MARISAT spacecraft, this system provides the primary C^3 for Naval forces. These satellites are in geosynchronous orbits and so remain over fixed points along the equator and are visible to receivers between plus or minus 70 degrees latitude.

Defense Satellite Communications System (DSCS)—This program provides long-haul SHF communications relays for all United States military users. It also provides intra-theatre communications among small portable ground sets. These spacecraft are also in geosynchronous orbits.

AFSATCOM—This is a system of UHF transponders placed on other "host" spacecraft (e.g. FLTSATCOM). Their primary mission is to relay orders to United States strategic bomber forces, in particular, the "go-codes" or Emergency Action Message (EAM) as it is known.

Satellite Data System (SDS)—These spacecraft relay communications from the Air Force base at Thule, Greenland to the United States. They also host AFSATCOM transponders to provide communications to strategic bombers in the polar region where auroral disturbances make regular high frequency communications difficult. These are the only United States communications satellites not in geosynchronous orbits. Instead, they are in highly eccentric 12-hour orbits which carry them high over the northern regions for about 8 hours per revolution. This means they are visible to receivers at latitudes where the geosynchronous satellites are below the horizon (i.e. latitudes greater than 70 degrees north).

WEATHER SATELLITES

The United States Department of Defense maintains weather satellites in the Defense Meteorological Satellite Program (DMSP). There are two spacecraft placed in circular 12-hour sun synchronous polar orbits which allow them to transmit data at the same local time twice each day. One satellite does this at local dawn and dusk, and the other at local noon and midnight. Consequently, tactical commanders can expect weather updates every six hours. This can be vitally important in theatres where cloud cover plays an important role in tactical missions (e.g. masking troop movements, scheduling reconnaissance missions, charting fleet routes, etc.).

NAVIGATION SATELLITES

The current DOD radio navigation satellites are called TRANSIT. These were first launched in 1960 and are

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one of the oldest continuing DOD space programs. They broadcast harmonic signals that allow receivers to calculate their position by coupling the doppler shift with knowledge of the satellite ephemerides.

Originally, the TRANSIT program was developed in support of the Polaris submarine program. Polaris submarines (and later the Poseidon submarines) receive TRANSIT signals by periodically floating an antenna buoy. This data is required to keep the submarine launched ballistic missiles (SLBMs) guidance systems updated. Their inertial navigation systems must have an accurate knowledge of where they are being launched from to get to targets with reasonable accuracy.

In addition, other naval vessels use the TRANSIT radio navigation system and, since 1968, it has been available for civilian use and has been widely used for commercial navigation.

In the mid-eighties, the DOD will deploy a larger, more comprehensive satellite radio navigation system called NAVSTAR. This system will operate in a fashion similar to TRANSIT, but will consist of 24 spacecraft orbiting in three planes (eight in each) separated by 120 degrees. Signals from these spacecraft will allow receivers to compute their location to within 8 meters in the horizontal, within 10 meters in the vertical, and velocity within $^1/_{10}$ knot. Developed mainly to aid in tactical weapons delivery, this system will eventually be used by all branches of the military and receivers for land vehicles, ships, aircraft, and manpacks are being developed. (In addition, it is expected to become a primary radio navigation system for civilian use as well, although this role is not yet defined.)

OTHER SATELLITE SYSTEMS

The remaining DOD satellite programs involve reconnaissance and intelligence gathering missions and are highly classified. These programs provide enormous amounts of data that aid long term force structure decisions as well as quick decisions concerning the tactical employment of weapons. They cover the range of forces, from early warning of a strategic nuclear attack (e.g. the United States Defense Support Program or DSP), to the movement of conventional forces.

SPACE WEAPONS

Given the critical role of the above military space systems in the command and control of forces, satellites may be considered nodal points through which large concentrations of military power flow. This alone makes them salient targets. However, other characteristics make spacecraft even more tempting targets. They are remote, their positions are generally known, they are fragile, and, with few exceptions, they are unmanned. These characteristics make the problem of defense in space very difficult. The advantage lies with the offense. It is much cheaper to attack a spacecraft than it is to defend or replace one.

INTERCEPTORS

There are an assortment of potential antisatellite (ASAT) measures that

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might be employed. The only ones developed to date have relied on ground-launched interceptors. The United States is reported to have had a modified ABM missile on Johnston Island (deactivated in 1975) which was configured to intercept low Earth orbit spacecraft as they passed overhead.[4] It was a ballistic interceptor of limited range and thus, had to wait, in effect, for the target to come to it.

The current Soviet system also utilizes a ground-based interceptor, but it is launched into an orbital trajectory by a modified SS-9 ICBM.[5] This allows a greater range of targets and more flexible response time than the United States system had. However, it too is limited to fairly low Earth orbits (it has been tested at altitudes up to 1000 km).[6] The Soviet system is presumed to rely on an explosive charge to disperse shrapnel and kill the target.[7]

From Table II, it may be seen that these Soviet interceptors have sufficient range to attack all the current United States spacecraft except those at geosynchronous altitudes. Intercepting those satellites requires more energy and sophisticated guidance. Low Earth orbit intercepts can be more readily monitored and guided by Earth-based surveillance systems. Tracking and guidance of an interceptor at geosynchronous altitudes from ground would be much more difficult. This would tend to drive an ASAT designer to use an active (radar) or passive (LWIR sensor [Long Wavelength Infrared]) seeker on his interceptor for accurate guidance.

A way of mitigating the stringent accuracy requirements is to enlarge the lethal radius of the ASAT interceptor kill mechanism. The most efficient way of doing this would be to use a nuclear warhead. A nuclear detonation generates an electromagnetic pulse (EMP) which would be highly lethal to delicate spacecraft components over very large areas (on the order of hundreds of kilometers, depending on yield).

Another alternative for taking out geosynchronous spacecraft would be to station a killer satellite in orbit prior to the attack being executed. Such a spacecraft would not be identifiable to Earth-based sensors and could be prepositioned on orbit in a dormant mode. When an attack was directed, it could be moved to its appropriate target and detonated. This would tend to reduce warning time that an attack was going to be carried out.

The utility of the geosynchronous orbit for so many missions of communications and warning spacecraft also makes this a very concentrated target set which could conceivably be exploited by a space weapon system. For instance, by placing a payload in an orbit of 0° inclination, but either slightly higher or lower than geosynchronous altitude, it will pass relatively close to *all* geosynchronous spacecraft in a fairly short period of time. It is not difficult to imagine a weapon system that could be designed to disable each spacecraft as it were passed. The killer satellite might sim-

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ply disperse a cloud of pellets at the appropriate positions. Survivability of geosynchronous altitude spacecraft is a very critical problem and military space program planners will have to address it.

LASERS

Much has been made of the potential for high energy laser (HEL) weapons and in particular, laser weapons in space. This attention is warranted. Department of Defense funding levels reflect intense interest in this area.[8] It is also safe to assume that the Soviet Union is actively pursuing these technologies as well.

A very good general discussion of the weapons applications of lasers was printed in the October 1977 issue of Analog. The Hecht and Nahin articles provide a good overview of all aspects of current HEL research (to the extent possible in the open literature). Only the ASAT applications of lasers will be mentioned here.

Two modes of ASAT operation are possible—ground-based and space-based. Ground-based lasers would have the advantages of easy access, no weight constraints for power sources, and easier tracking and pointing. They would have the disadvantages of atmospheric attenuation, and range limits which, like the United States recently dismantled ABM/ASAT on Johnston Island, would force it to wait for targets to be overhead. A ground-based ASAT weapon is the most likely near term HEL application.

Space-based ASAT lasers will demand the development of high power sources with low weight and extremely fine remote tracking, pointing, and command and control capability. Of course the huge advantage of space-basing is the lack of atmospheric interference.

Both basing methods will require scaling up current energy levels to achieve reliable kill capability. None of these problems is readily solvable, but those affecting the ground-based system can be more readily dealt with due to its accessibility. However, a HEL would be most effective in the space environment and it is likely that any ground-based HEL would serve in only a limited operational way.

An HEL might inflict damage upon a spacecraft in one or more ways. It might deposit sufficient energy on the spacecraft's surface to generate lethal heating or structural damage. Solar panels are particularly vulnerable to this threat.

Alternatively, the laser might be employed against the satellites mission sensors. The infrared detectors which are the prime mission on the United States DSP early warning spacecraft could be vulnerable to such an attack for example. These spacecraft provide the first warning of an ICBM or SLBM attack on the United States by detecting the infrared signatures of missile exhaust plumes. Directing an HEL at these sensors would blind them by temporarily saturating them or permanently damaging them.[9] Similarly, damage could be inflicted against the visual and infrared imaging systems of other satellites (e.g.

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weather and reconnaissance missions).

Finally, it has been suggested that a laser could be used to confuse a satellite's horizon sensors which are used to maintain spacecraft orientation towards Earth by locking on to the Earth's limb. Proper orientation toward the Earth is critical to virtually all satellites and laser interference with these sensors could either permanently damage them or cause the spacecraft to rapidly deplete its limited supplies of on-board fuel and thus effectively destroying the satellite.

ELECTRONIC WARFARE

Electronic warfare is a threat to any military use of the electromagnetic spectrum. The nature of satellite vulnerability to such measures is highly classified, but Lt. Col. Richard E. Hansen (A.F. Ret.) has written that "spoofing or suicide-inducing commands" might be generated by an enemy. Such signals "could alter a satellite's position; cause it to leave its position in geosynchronous orbit; deny it power by disorientating sun-pointing solar cells; desynchronize Earth-pointing antennas; fire thrusters causing orbital decay; trigger and receive stored radio transmissions . . .".[10] These avenues of attack, if possible at all, would be limited in their effectiveness during a wartime scenario because they might not be timely and their effects would not be readily confirmable to the attacker. Therefore, in an open conflict, it would be more likely that the previous methods of attack would be utilized.

SPACE DEFENSE—ASAT COUNTERMEASURES

As pointed out above, satellites are intrinsically very fragile and vulnerable objects. They make very good targets for a variety of weapons. Nevertheless, there are various approaches that may be pursued to enhance their survivability.

PROLIFERATION

The most obvious manner of improving space system survivability is simply to multiply the individual satellites. An example of this is the Soviet Molniya communications satellite system which utilizes a large number of individual spacecraft to perform a mission similar to that of the United States DSCS and FLTSATCOM systems (which employ only a very few spacecraft—see Tables I and II). Consequently, the Molniya communications system would prove much more difficult to destroy completely and would go through a much more graceful degradation of service as successive satellites were attacked. In contrast, the United States would suffer instant communications outages in large geographic areas with the loss of each spacecraft. The drawback to proliferating satellites is that it is expensive, especially for the United States. The United States spacecraft are far more complex and costly than their Soviet counterparts and while proliferation is a physically possible method of enhancing survivability, it is not a fiscally attractive approach for the U.S.

QUICK-LAUNCH REPLACEMENT

Another approach to maintaining

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the spaceborne segments of some systems during a conflict would be to have replacement satellites available for rapid launch. These could either be identical spares or simpler satellites designed only to fulfill basic mission requirements. The launch vehicles might be either stored expendable vehicles of the sort currently in use today (i.e. Titans, Deltas, Scouts, etc.) or the Space Shuttle. However, launching the Shuttle during a conflict may be risky because it is such a vulnerable target and because so few of them will exist (four or possibly five).

HARDENING

There are techniques to make satellites more resistant to attack. These include electromagnetic pulse (EMP) protection, replacing solar panels with radioisotope thermoelectric generators (RTGs), and using inertial (rather than horizon or star sensing) orientation systems. These techniques offer only limited protection to some types of attacks. The nature of nuclear EMP effects is poorly understood and hardening against them may be more an art than science. Replacing "soft" solar panels with compact RTGs increases a spacecraft's survivability to both laser and shrapnel effects as well as reducing its radar cross section (see below). However, the rest of the spacecraft still remains highly vulnerable to these methods of attack.

Under a DOD contract, MIT's Lincoln Laboratory designed and built a pair of satellites (called LES 8 and 9) which were launched in March 1976 and tested some of these techniques. These spacecraft were extremely successful and future spacecraft may employ these features as a matter of course.

HIDING

It has been suggested that satellites may be hidden in orbit.[11] This could entail positioning satellites at altitudes far beyond geosynchronous (five times geosynchronous has been suggested). At these altitudes, satellites would not only be extremely difficult to locate and target, but would require a large amount of energy and time to attack with an interceptor.

Of course, only some missions would lend themselves to this technique; primarily communications satellites. Other satellites require near Earth orbits or would gain nothing by being placed at greater distances because constant radio frequency emissions give away their location. (Communications satellites hidden at these "supersynchronous" altitudes could be left in a dormant mode until activated as required.)

In addition to placing spacecraft at high altitudes for concealment, efforts to reduce the satellite's radar reflectivity could be employed. These include reducing the physical radar cross section (particularly by replacing solar panels with RTGs) and by utilizing radar absorbing materials.

In summary, none of these approaches to enhancing spacecraft survivability may be relied on to any significant degree. The advantage in space conflict will, for the foreseeable

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future, lie with the offense.

ARMS CONTROL IN SPACE

The development of efficient satellite weapons coupled with the critical dependence upon space systems for national security generates a tension and potential instability in the strategic balance between the United States and the Soviet Union. The ultimate threat to national security is an all-out strategic nuclear attack. The successful destruction of communications and warning satellites would greatly diminish the ability of the attacked nation to retaliate. This vulnerability is significant and becomes more so in a crisis scenario. In a confrontation, if both sides have antisatellite systems deployed, a large incentive to go first will exist in the space arena. Assuming that no adequate defense system for spacecraft is developed in the near future (and none is likely), then a situation will present itself where decision-makers may face a "use or lose" dilemma concerning their space systems and weapons. This is similar to the "use or lose" dilemma associated with vulnerable ICBMs. The natural question is, can we mitigate these tensions and perhaps even avoid the costs of an "arms race" in space through negotiated arms control agreement?

Presently there are several international accords governing activities in space, but only a couple have any impact on ASATs.[12] The major restrictions are that nuclear weapons tests are prohibited in space (1963 Limited Nuclear Test Ban Treaty) as is the stationing of "weapons of mass destruction" (1967 UN treaty on principles and activities in space). In addition, the 1972 ABM treaty bans the development, testing, or deployment of ABM systems in space. The treaty specifically defines ABM systems as including interceptor missiles, launchers, and radars that have been used or tested in an ABM mode. Two points are significant. First, an ABM and an ASAT weapon may be indistinguishable. Second, other types of ABM systems not included in the treaty definition (such as high energy lasers) may be developed.[13] These gray areas are destined to cause difficulty in the future if they are not clarified.

Another specification of the ABM treaty relates to protecting the ability of each side to perform adequate verification. The treaty forbids interference with "national technical means of verification," a phrase commonly understood to mean reconnaissance satellites.

Aside from these points, no other treaties significantly affect ASAT development, deployment, or use. There are, therefore, few real restrictions on war in space.

It would seem that early recognition of the problems of satellite weapons by both the United States and Soviet Union might allow some form of negotiated accord between the two countries to limit some expenditures and activities in this new arena. There are unique characteristics to the arms competition in space which may make

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it more amenable to limitation than terrestial weapons systems. The first and most important is that the ability to destroy spacecraft is likely to be far easier than the capability of defending them. Keeping in mind the tremendous utility of space systems to Earth-based users on both sides, it could be mutually beneficial to agree not to develop satellite warfare systems.

A second feature of our current position with respect to space defense is that attacks against spacecraft represent a threshold that has never been crossed. Chances of an agreement banning weapons designed for satellite warfare will diminish greatly if the threshold is crossed before such an accord is arrived at.

A third aspect of the present situation is that to date, no satellite weapons have been stationed in orbit. It will be much easier to forbid such activities before they are begun.

A treaty addressing satellite weapons is potentially the most feasible area for an accord between the superpowers. If accomplished, it would have the additional advantage of preempting the problem, outlined above, of distinguishing between antisatellite systems and antiballistic missile systems in space.

This potential opportunity for gaining some control over the direction of space development has not escaped the attention of the present United States administration. This past June, talks with the Soviets were initiated at a meeting in Helsinki. Little was revealed to the public concerning the substance of the discussions, but given the current difficulties in obtaining a second SALT accord, and the overall souring of U.S.-Soviet relations, one should not expect rapid progress.

In addition to the difficulties presented by the political environment, there are major obstacles inherent in the problem itself. Looking at the ABM treaty as a model for a potential ASAT arms control agreement, critical differences between the ABM and ASAT issues become evident.

The primary one is that the ABM systems which were limited in the 1972 treaty were basically infeasible for what it was argued they would do. They were not an effective way to defend against incoming reentry vehicles because it was much cheaper to build reentry vehicles than defenses and therefore, saturation of the defending ABM was always possible. This fact, recognized by both sides, made a treaty banning them relatively easy to agree upon (although it still required several years to achieve).

In contrast, antisatellite systems will work efficiently—very efficiently. The cost of satellite weapons will be far less than their targets. This fact will greatly impede any mutual agreement to relinquish them. It is easier to give up something which is useless than something which is useful.

A secondary difference between the ABM systems and antisatellite systems is the circumstances under which they may be applied. ABM systems are useful only in strategic nuclear war. Nuclear war being what it is (or

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what it is imagined to be), lacks utility as an instrument of political or military policy.

On the other hand, ASAT systems could be used in more than the strategic nuclear war scenario. They could have great utility in a European conflict and other non-nuclear instances can be conjured without difficulty. Imagining the instances of their use does not immediately bring to mind images of cities incinerated by the fireballs of nuclear detonations or the quick and prolonged deaths of millions of individuals the way ABM systems do. The fact that antisatellite systems only represent the destruction of unseen pieces of electronic gadgetry reduces the visceral sense of concern that was attendant to the ABM debate.

Moreover, because the antisatellite systems have more diverse applications, there will be greater reluctance on the part of competing countries to ban or restrict them.

Yet, the most substantial difficulty in creating a treaty concerning satellite warfare is the issue of verification. Space is huge and three-dimensional (for practical purposes) and a surveillance capability comparable to that which allows verification of the ABM accord is technologically a long way off. Even assuming adequate surveillance to detect all objects out to geosynchronous orbits (a capability not current extant), it is still necessary to be able to identify the spacecraft's function. Given the possibilities for disguising satellite functions, this capability is not something which is just over the horizon. Perhaps when manned spaceflight becomes more routinely employed, inspection missions could be employed. However, during the same time that verification techniques are being developed, so too will the weapons for satellite warfare, and the technological obstacles for those developments appear lower.

A treaty limiting something which is as potentially critical to national security as antisatellite weapons will depend upon methods of verification satisfactory to within reasonably high limits of confidence. An extraterrestial writing home about the two-legged creatures without feathers on Earth would not emphasize their native trust of one another. A consequence of this characteristic flaw is that arms control agreements may be designed in three ways. There are those which limit the useless, there are those which set useless limits, and there are those which set useful limits that can be verified by hard and fast measures. (Cynics would say the last of these is a product of another characteristic flaw of Earthlings—wishful thinking.)

It is unfortunate, but unavoidable, that at the time when such an agreement would be most beneficial and would save the most in defense expenditures, that the technology required to permit management of such an accord is so distant.

The only way out of this dilemma would be a ban on the testing of antisatellite systems; however, such an

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agreement would require accepting some points that national security planners would feel very queasy about. First among these is the fact that the Soviets have already tested and have had operational a satellite interceptor with significant capabilities. This would not sit well with many in the United States.

Second is the possibility that detectable testing of such antisatellite spacecraft may not be necessary. Returning to the case of attacking geosynchronous satellites, the only requirements are that the drift of a satellite also placed in geosynchronous orbit be controllable and that it can explode with enough shrapnel or a sufficient electromagnetic pulse to take out nearby spacecraft. Testing of such a system could be done surreptitiously without detonating any explosive.

Yet, if these obstacles could be overcome *or* the risks accepted, it would eliminate from space those systems which did require testing, and this could include the potentially very destabilizing space-based beam and laser weapons. Alternatively, and perhaps a better approach, would be to specify within such a treaty that beam and/or laser weapons be prohibited from being tested or deployed in space. This would limit the treaty to more readily verifiable elements. Verification difficulties might be more surmountable with regard to the testing of these systems. Further, such an accord could be accomplished before these weapons programs gain significant momentum and before large sums of resources are expended.

Even this sort of specific, verifiable treaty might not be achievable simply because the parties may not be willing to give up something which they do not fully understand. Trying to ban the testing of these types of satellite weapons may not be possible because their full potential has not been developed or even explored. It is another Pandora's box and it seems man is fated to open it and then deal with the consequences. It would be a true precedent to forge an agreement which limited a technological possibility before it reached any degree of maturity. Yet, if there ever was an opportunity for an arms control accord with such consequence, the approaching space-borne beam and laser weapons are it.

Taking a very broad view of military space development, the outlook for controls is not particularly bright in the near-term due to the verification difficulties, and the problem of inexperience in using space in an actual conflict of major proportions. Unfortunately, it would require another war to determine the real role of military space systems. The immediate goal of national policy makers must be to deter the next war and limit its consequences if and when it occurs.

A key to thinking about the role of space in such a war is to remember that we are still in a period where all the objectives of war are based on Earth. The functions of satellite warfare, should it occur, will be to aid the political and economic goals of one side or the other on Earth. Much more

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distant is the time when warfare will occur in space over space-based economic resources such as colonies at libration points and mining operations on the moon or asteroids. For the near future, assets in space will be considered as targets only with regard to their potential use to nations on Earth.

These potentialities are presently quite significant and will become more so. The prospects for achieving limiting agreements on spaceborne weapons are currently hampered by the deficiencies in verification techniques. Control of man's activities in space depends upon man. In the more distant future (the 1990s and beyond), the increased presence of man in space may help to mitigate the problem of verification of arms control agreements in space.

There will probably be ample military reasons for stationing men in space (e.g. reconnaissance, early warning, surveillance, etc.), yet other possible advantages may exist as well (the active Soviet manned space program appears to be exploring these possibilities). The discrimination capability of the human mind placed on an orbiting post where it could visually inspect and scan the space arena, could possibly provide the better and more believable verification required to monitor space arms control agreements.

However, another important consequence of having a continuous human element in space is that it might generate a moderating influence in any potential hostilities between opposing space systems. In an arena devoid of human presence, it is psychologically easier to begin destroying spacecraft. Adding a human presence raises this intangible threshold. Contributing to this attitude is the sanctity bestowed upon astronauts (and cosmonauts) by the 1968 UN treaty on the rescue and return of astronauts. It may be far easier to set limits and form agreements on satellite warfare when men are among the satellites.

As more personnel are dispatched on military space missions, it is likely that a process of acceptance of their roles and rights in space will occur. This will be analagous to the slow but certain process by which the need and acceptance of satellite reconnaissance flights came about. These flights were at first denied because they could be construed as an invasion of the sovereign territory of other countries. But as their benefits and stabilizing influence through the uncertainty they reduced have become evident, they have become more widely acknowledged.

Currently, the Soviets maintain that their military Salyut 3, 5, and 6 stations performed purely scientific missions (the onboard telescope is called a "solar" telescope, but has all the characteristics of a reconnaissance instrument and would have a ground resolution of 12-18 inches or less). This is similar to their claims about their military Cosmos flights. A corresponding reluctance to describe United States DOD Shuttle crew activities may also be expected.

In conclusion, the question is not

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whether there will be an "arms race" in space, but what kind and what directions will characterize the competition of the two superpowers in this environment. The expansion of society's activities into space has been motivated by more than the rudimentary desire to explore new territories. It has resulted also from economic incentives and national security incentives. Moving into space, societies do not leave their own flaws and foibles behind. These include distrust and a desire for self-preservation among coexisting but also competing societies. The more societal resources are invested in space, the more the insurance of their security will become a concern. This is in addition to the use of space to advance the security of a society's Earth-based component.

So, the militarization of space is a foregone conclusion. In fact, it already exists. However, we are at a very early stage and few precedents have been set. Therefore, the directions and trends for the military utilization of space depend greatly on actions taken now and in the coming years. This is a formative period when experimentation in space is shifting to the utilization of space. Societies no longer view their space assets as novelties but, rather, as necessities. Societies will evolve customs and procedures for their space activities as they have for all their Earthbound preoccupations.

The question is, to what degree will they evolve by accident or through thoughtful decision? Even if fate and chance cannot be overcome in their entirety (or at all), an attempt can and should be made to understand and affect the directions in which we are headed. At present, the future may be artfully shaped with relative ease by the decisions of prescient minds. Or, its shape can be determined by random events and incidents.

We now know enough about space to understand some of its potential and we should know enough about ourselves to understand how its potential will be applied. Realistic policies to guide the stable growth of space utilization by competitive social systems should be our goal. It must be attended to now, and a single integrated policy should be developed. Space policy should be developed at the highest levels of government and not allowed to sprout haphazardly in various scientific, military, and commercial sectors working in space.

This paper has concerned itself with the national security implications because these have largely been germinating without consideration of their broad effects on public policy in general. However, they will soon force themselves into the light of these considerations and the sooner the issues which will arise are identified, the better able we will be to deal with them. ■

NOTES

[1] For a virtual encyclopedia of Soviet space programs, see *Soviet Space Programs, 1971-75, Overview*, Staff Report for Senate Committee on Aeronautical and

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Space Sciences, U.S. Government Printing Office, Washington, D.C. 1976.

[2] These charts and the subsequent data on United States programs are excerpted from an unpublished Master's thesis completed by the author in Sept. 1977 at MIT.

[3] *Aerospace Daily*, 11 January 1978, p. 43.

[4] *Aviation Week and Space Technology*, 21 June 1976, p. 13. Also see Gunthrie, Brig. Gen. John R., "The Challenge of Army Requirements to Aerospace Technology in the 1970's", Defense Industry Bulletin, June/July 1967, Vol. 3 No. 6, p. 7.

[5] *Aviation Week and Space Technology*, op. cit., p. 13.

[6] *Aviation Week and Space Technology*, 4 July 1977, p. 19.

[7] Washington Post, 7 November 1977, p. C-1.

[8] Statement of Dr. Malcom Currie to the House Armed Services Committee in Hearings for FY 1977, Part 1, p. 1464.

[9] *Aviation Week and Space Technology*, 8 December 1975, p. 12.

[10] *Aerospace Daily*, 6 February 1978, pp. 192-193. Also, Washington Post, op. cit., p. C-4.

[11] *Ibid.*, p. C-4.

[12] Agreements concerning space include the following:

- — *1963* Limited Nuclear Test Ban Treaty
- — *1967* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies
- — *1968* Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of ObjectsLaunched into Outer Space
- — *1972* Convention on the International Liability for Damage Caused by Space Objects
- — *1972* The SALT I Soviet-United States ABM Accord
- — *1975* Convention on Registration of Objects Launched into Outer Space
- — *1977* Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques
- — *1973* International Telecommunication Convention
- — *1977* Agreement Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes

[13] In an "agreed interpretation" of the ABM treaty (signed by both parties), it was stated that if ABM systems based on other physical principles be developed in the future, then they would be subject to discussion by the Standing Consultative Committee set up by the treaty.

[14] *Aviation Week and Space Technology*, 25 February 1974, p. 38.

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the reference library

SPIDER ROBINSON

IN TWO PARTS

PILGRIMAGE TO EARTH, Robert Sheckley, Ace, 244 pp., $1.75
RETIEF AT LARGE, Keith Laumer, Ace, 440 pp., $1.95
RETIEF AND THE WARLORDS, Keith Laumer, Pocket, 175 pp., $1.75
THE GIRL, THE GOLD WATCH, & EVERYTHING, John D. MacDonald, Fawcett, 207 pp., $1.50
THE LIGHT AT THE END OF THE UNIVERSE, Terry Carr, Pyramid, 304 pp.
BLOOD & BURNING, Algis J. Budrys, Berkley, 227 pp., $1.75
MINDSWAP, Robert Sheckley, Ace, 213
ECOTOPIA, Ernest Callenbach, Banyan Tree, 168 pp., $2.95 Bantam, 214 pp.
ALIEN EMBASSY, Ian Watson, Ace, 306 pp., $1.75
MIRACLE VISITORS, Ian Watson, Ace
THE SCIENTIST, John C. Lilly, M.D., Lippincott, 210 pp., $8.95
CATACOMB YEARS, Michael Bishop, Berkley, 396 pp.
SIGHT OF PROTEUS, Charles Sheffield, Ace, 282 pp., $1.75
A DIFFERENT LIGHT, Elizabeth A. Lynn, Berkley, 183 pp., $1.75

It's got hold of all of us. This nagging subconscious conviction that we are, in all things, on the wrong side of the anabolism/catabolism seesaw. It's got hold of me. I own a 1970 auto, so savaged by seven years of being parked next to the Bay of Fundy that there's fungus on the whiskers that are growing out of the rust, and I'm seriously considering spending a good deal of money I don't have to put the old bus back in shape, rather than spend approximately the same amount on a new (or at least newer) car. Everybody knows the new ones are candy.

Similarly, the most expensive guitar Gibson sold this year didn't sound as good as my mistreated eighteen-year-old J-45, and there was a time when a man could expect a hardcover to be bound better than a paperback, and nobody but a dumb city kid would pay good money for a *new* splitting axe, and as Spider John Koerner said years ago, they ain't hardly a woman alive now that can sing a blues the way old Billie Holiday used to do, and in general, as Alfie Bester wrote at about the same time (to drive my point home instead of just giving it carfare), they don't make life like they used to.

On the other hand, at the time when my car was assembled, you could not buy a computer that could fit in your VW, let alone your vest pocket. When they lovingly hand-assembled my J-45, you had to go many miles to buy strings, and they didn't make unbreakable nylon picks. Back when they made my trusty old splitting axe, they did *not* make chainsaws that a skinny city kid could handle, and if you wanted a good cup of coffee you had to

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make it by hand. When The Lady With The White Gardenia was alive, no recording studio on Earth could offer her the technical quality of the Sony reel deck in my living room, let alone the 64-track monster systems that top-40 disco chumps now take for granted (nor could she, a black woman, use the ladies' room at many of her gigs).

And when Alfie wrote that story, they did not publish a thousand SF titles a year, nor distribute them one-tenth so well.

Ah, but did they *write*'em better in those days?

That of course was the central question behind the New Wave/Old Wave controversy which generated so much heat and so little light a few years ago. The only possible answer, of course, is "depends on what you mean by 'better'." And right there discussion must fall apart—often most entertainingly.

But I think it's obvious that the way they're writing'em in 1978 is *different from* the way they were writing'em in the 50s and 60s, and perhaps it would do no lasting harm, now that the smoke has cleared, to examine some of those differences.

Fortunately for the tired reviewer, this takes no effort at all. The good cars, guitars and such are gone forever or fading fast; the few survivors are geriatric cases scarred by time. We who love SF are luckier: a good SF book is immortal. Better than half of those thousand annual titles are reprints.

Isn't that marvelous? I would give a lot to have a reprint of my old 1960 Dodge Pioneer with the pushbutton transmission that goddamn it worked *fine*—but they haven't got any steel of that grade left in all Detroit. Yet the book I was reading at the time is available in a brand new paperback with a spiffier cover, and I can't prove it but I think a paperback of today is made and bound *better* than a paperback of twenty years ago (ask me again in twenty years).

I didn't plan this: I selected the books for this column the way I always do. (I pick up whatever looks like I might enjoy it, and report on what happens.) But if half the books printed are reprints, half the review copies sent out are liable to be reprints, and therefore half of a random selection thereof are liable to be likewise, and so it should not have surprised me, when I had piled this month's targets in two anally retentive equal stacks on my desk, to discover that one pile was all new stuff and the other was all old stuff. I was surprised, but then I'm a well-known dullard. (Come to think, though, if I ever lose my ability to be surprised I'll be finished as a writer.)

Not so dull, however, that I don't know a made-to-order lead when I see one, serendipity doo-da-day.

This is going to be interesting. I have no idea where I'm going with this; I'm as curious as you are (possibly more so). Although I didn't read them in any particular order, let us consider these books in their two chronologically segregated piles, beginning with:

THE OLD STUFF

There is, of course, some overlap. For the purposes of this safari, we will arbitrarily consider "old stuff" to be any book published before 1970.

The oldest stuff here is **PILGRIMAGE TO EARTH**, a collection of vintage Robert Sheckley short stories dating

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from 1952-6. Of all the books I read in the last few months, this was the most "enjoyable" in the sense that it was painlessly entertaining. Sheck didn't invent the sardonically funny, broadly-sketched, fast-paced and absolutely bite-sized Wacky Problem story: he just perfected it. And sold it enough times to satisfy even an addict like me in the 50s. His collections were like Alfred Hitchcock anthologies—not only were they utterly reliable, but most if not all of the stories were short enough to finish in a single class period and still leave time to display attentiveness at beginning and end.

Pilgrimage is a reasonably representative sample. Some of these are light, frothy stuff, with the characteristic Sheckley craziness. Two human junkmen accidentally reactivate an ancient alien lifeboat—and its sentient but senile computer mistakes them for its long-dead passengers and insists on "bearing them to safety." An interstellar explorer is fitted with the prototype of a Perfect Protection Suit *which he cannot remove*, and of course winds up in a situation where the suit's very perfection threatens to kill him. The brain of an eminent mathematician is transplanted on his death into the body of a dog. Like that. Some pack a little more freight, like the parody-*cum*-satire about the faithful old robot Gunga-Sam, who benevolently manipulates his beloved Massa into a suitable marriage ("Human Man's Burden") or the incredible "Fear In The Night," which sets up and detonates total horror in the space of five pages. And one of the stories, the first and title story, goes right for the gut and breaks it off inside.

Virtually all of them build up to an ironic-twist ending in the last sentence, and there isn't a spare word on any of them, all as economical and dependable and seemingly effortless as Astaire choreography or MGM reruns or David Bromberg albums. Nothing experimental or confusing or frustrating, and each story is long enough to be enjoyable but short enough to finish before someone starts banging on the bathroom door. I don't know about you, but I've got to have a couple of these around the house at all times, to nibble at.

Keith Laumer's Retief stories, for instance. Is there anyone out there who doesn't know Jame Retief, galactic diplomat? He is the archetypal Invincible Hero, James Bond with a conscience, Simon Templar in Civil Service, Robin Hood working undercover at Nottingham City Hall. Following a personal code of ethics indistinguishable from the Code Of The West, Retief time and again manages to save Decent Folks (human or alien) from both the ruthless cleverness of the ee-vul Groaci and the venal buffoonery of his own superiors in the Corps Diplomatique Terrestrienne, without ever turning a hair or losing his cool. What makes the same old formula work again and again, despite its predictability, is Laumer's brilliant plotting and inimitable sense of humor and unparalleled ability to create wacky alien cultures with a nutball logic of their own.

RETIEF AT LARGE is the best buy currently available in Retief stories: a round dozen of them, 440 pages of entertainment for $1.95. As with the Sheckley collection, these stories are designed to be read at breakneck pace,

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and you can read'em in a crowded bus without missing anything. Good Light Read is the technical designation; professional entertainment. There's a Retief novel out too, one of two I know of: *Retief And The Warlords*. It's the same kind of simple fun at greater length. Retief crashlands a half dozen space ships without a scratch, and wins an insanely complicated war more or less singlehandedly, and a plot summary would confuse P.G. Wodehouse himself (God rest his silly soul). The torture scenes are hilarious, and there's one marvelously outrageous *deus ex machina* whereby an alien drug so speeds up Retief's metabolism that time effectively stops for everyone but him—allowing him to rescue any tight situation not only painlessly but humorously. A galactic farce, with polish.

Ironically enough, the exact same gimmick is the basis of **THE GIRL, THE GOLD WATCH & EVERYTHING**, a recent reprint of the best of John D. MacDonald's three SF novels. (You *do* know MacDonald's extraordinary Travis McGee series? Tremendous stuff.) Only here the gimmick is not a drug that stops time for Kirby Winter, but a marvelous watch, bequeathed him—along with endless trouble—by his eccentric Uncle Omar. You twist the stem and time stops for as much as one hour of subjective time. The experience is precisely as Laumer describes it, light red-shifting, objects hard to move, etc. (to stave off the one or two outraged idiots I seem to get every column, I must add that I am not even hinting at plagiarism, and haven't even looked to see whose copyright is earlier. You don't copyright ideas—and anyway this one predates both Laumer and MacDonald by a good bit). Around this gimmick MacDonald builds a plot every bit as complicated as Laumer's—but the resulting book is quite different in impact. Because MacDonald cannot help but create real, warm, living, breathing *people*, even when he's *trying* to write comic stereotypes. Kirby Winter is anything but an unflappable hero; he is a sort of pleasant, ineffectual nebbish who must work hard to stay afloat in MacDonald's flashflood plot. This too is right from stock, but Kirby succeeds-in-the-end with growth-of-character that feels genuine rather than inevitable. And whereas the only women in Retief stories are cupcakes or battle-axes or sex-object prizes for Retief to claim, MacDonald offers us three genuine and convincing females, one evil, one foolish, and one just *charming* (Miss Bonny Lee Beaumont, perhaps the most unlikely and most delightful heroine in SF). Still a good light entertainment, but you'd lose something by reading this one on the bus.

We begin to move away from "pure" entertainment as we move past the early 60s—at least when we come to the stories in Terry Carr's **THE LIGHT AT THE END OF THE UNIVERSE**.

Not that these stories are not entertaining. But there's a noticeable difference between this kind of entertainment and the relatively undemanding type purveyed by Sheckley and Laumer and MacDonald (in the books specified). The themes begin to get as complex as the plots, the styles a little more inventive, the endings less predictable. Consequently the satisfaction is in the end a little deeper.

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This is only a tendency—this collection contains some standard formula stories (good ones), and these generally turn out to have been written in the early and middle 60s. By the late 60s and 70s, Terry had graduated from formula to solid food. Instead of sending the reader happily to bed, the idea becomes to keep him up until two in the morning thinking about the story he just read. To restructure, however temporarily, the way he perceives reality, and thus leave him a little *less* certain than he was. To create unstereotypical characters, and lead them into very odd places. Terry does it splendidly.

The same tendency is visible in Algis Budrys's collection **BLOOD AND BURNING**. That's one of the most apt titles I've ever seen; if you just came here lookin' for a good time, sailor, you're in the wrong joint. There is not one jolly, harmless, predictable story in the book, not a single happy ending, nary an encouraging word in sight. Some of the stories shock you, some depress you, some frustrate you, and some horrify you. They are peopled with compulsives, killers, hunchbacks and hermits and cripples and psychopaths. And victims; quite a few of those. Even the least of these stories is written with massive skill and power and control. Reading them is, in a sense, like being worked over by a really competent armbreaker who enjoys his work, and I would have to say that they are some of the most memorable stories I have read this year (one of them, "The Master of The Hounds," won a special Edgar Award from the Mystery Writers of America, and a few appeared here in Analog). Don't ask me why I was able to finish a whole book of brilliant Budrys bummers (say that three times fast) when I couldn't finish Gardner Dozois's equally-well-crafted *Visible Man* stories last column. Maybe it's that Budrys's stories are short and Gardner's are long, or that Budrys' victims aren't all that likeable.

Regardless, I quite enjoyed *Blood and Burning*, but I wouldn't pick it up at bedtime for all the tea in Colombia. In fact, you might not want to read it alone.

The last and most thoroughly delightful of the reprints, dated 1966, is by—surprise!—Robert Sheckley. But **MINDSWAP** is a different Sheckley. I've read some of his other, earlier novels—they too tended to be somewhat "conventional," following kooky conventions laid down by Pohl & Kornbluth. But *this* thing: imagine the conventional teller of witty SF stories, rip-roaring stoned behind his first hit of acid, piling all his formulas and conventions in a heap, setting fire to them, and urinating gleefully on the ashes. Virtually every pulp convention ever congealed gets danced on in this book, and every tenet of story logic (of logic itself) gets tied into pretzels. The pace is completely lunatic; Sheckley finishes each chapter in such hysterical frenzy that you're sure he's written himself into a corner—then by God he shifts gears and *accelerates* in the next chapter every time.

Starting premise: Marvin Flynn answers a perfectly ordinary classified ad from a Martian wishing to swap bodies for a week. But when he arrives on Mars, Marvin learns that the Martian sold his body to several beings at once, and Marvin's claim is worthless. He

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has a matter of hours to find a body for his psyche to inhabit before he is . . . evicted. A plot summary is absolutely out of the question, but I will tell you that Marvin is ultimately forced to track his enemy into the literally indescribable Twisted World (from which one either never returns or is always returning or both). This book makes Alfie Bester's *Computer Connection* look staid, makes *Catch-22* seem sane and pedestrian, makes the Firesign Theatre look like Bob and Ray.

The humor in *Mindswap* might well be described as "intellectual slapstick"—that is, an English major would probably find it (and the whole book) more accessible then, say, a Geology major. Whereas a good Geology major would have a marvelous time with, say, Retief or the MacDonald. Which should not be taken for disparagement of either kind of humor, or of Geo majors (or of any person now living or dead, okay?)

But I was an English major for six and one half years, and *Mindswap* made me laugh so hard I hurt myself.

And so we pause, puffing just a bit, to look over what we've covered so far. There's an emphasis on entertainment, on painless diversion, and a reasonably strong tendency to be funny: the Carr and Sheckley collections are roughly half-farce and half-downer, the two Laumers, *Mindswap* and the MacDonald are straight farce, and the Budrys is so unfunny it's funny. I would say that with the possible exception of Budrys and some of Carr's more ambitious stories all these writers were, in Heinlein's words, "competing for the customer's beer money." Even in those exceptions, however, you will find only a handful of ideas or concepts that could be called new or unique: most of these writers dealt in clever twists on familiar ingredients, an ancient and honorable occupation.

Note that almost invariably they took *one* nutty premise and extrapolated thereafter with rigorous logic.

It is also interesting to note a strange kind of pessimism: whenever one of these authors wrote about the future, they more or less always assumed that it was going to be much like the present, only worse. That is, none of them posited any particular spiritual, moral or ethical *growth* in the human race, none of them envisioned any substantial changes for the better in human nature as a result of all the technological change—all the far-future cultures seem to be based on the *worst* postulates of our own. Frequently this resulted in a future so unpleasant that one had to either laugh about it or get depressed, and they took their varying choices. By the time we are able to send ambassadors millions of light years, we will still be so immature that all the ambassadors will be venal jackasses, says Laumer. One day the last man on Earth will sit surrounded by faithful, concerned robots, swearing at them and drinking himself to death, says Carr. They don't give a sucker an even break anywhere in the known galaxy, says Sheckley in *Mindswap*. Damned if I can find a single visionary future that contains any improvements over the present, barring gadgetry. This made everybody fall down laughing. This leads us smoothly to: THE NEW STUFF

TO BE CONTINUED

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asstacksbrasstacks

Dear Mr. Schmidt,

I am very sorry to see Ben Bova leave as editor of Analog. If you do half as good a job as he, then you will have achieved excellence.

I have read and seen quite a number of articles on and about the subject of solar energy, and as usual, I think man is reinventing the wheel. The most efficient solar collector is already in existence, there are millions of models to choose from, most of them being light-weight, cheap, passive and self-repairing. I speak of the lowly plant.

Perhaps my views will seem a little strange to an audience of advanced technologists, but I know where my energy and my air comes from. Thank God the oil companies don't own the sunshine! It's time that we stopped sinking all our eggs in one basket. You want an efficient energy collector? Take a look at a tree. Some trees are as complicated as a nuclear reactor, but (miracle of miracles) work automaticly, and without waste that will have to be sent to the moon, or watched for (at best) *centuries* . . . . And if we wait for the other half of the technological twins, fusion (fission's cleaner brother) we might wait 'till hell freezes over, and then we will really be in a bind, because we will have exhausted our (some how, these plants became *our*) fossil fuels completely.

What I am saying is that mankind must resolve his/her identity crises with respect to the Earth. Time is fast running out. Soon, it will be the *survivors* problem.

P.S. I am an honors student at Temple University, and a reader of Analog for as long as I can remember.

DAVID FOSTER
1220 N. Broad St.
Phila., PA 19121

True, plants do admirable work in energy conversion—but they don't convert it to the forms people are after with technology. If you can suggest ways to achieve that, you'll really have something. SS

Dear Editor,

When I was reading Ralph Hamil's stimulating article on "Terraforming the Earth" (July 1978), my seismograph detected a tremor coming from Sicily. That was produced by Archimedes turning in his grave at Hamil's assertion (p. 52) that the proposed melting of the Arctic ice cap "would raise the level of the world's oceans, drowning seaports and other valuable land."

Since the Arctic ice cap is floating in the ocean, then we know (by courtesy of Archimedes) that the volume of seawater displaced will have weight equal to that of the ice. Accordingly, whatever other effects might result from melting the Arctic ice cap, any directly ensuing changes in sea level would be the minute results of any change of temperature and the dilution of the saline sea by the melting of

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the salt-reduced ice. The fact that the Arctic ice cap is large enough to have an appreciable curvature does not affect the argument—indeed, the diagrams in Archimedes' treatise *On Floating Bodies* depict objects floating on a sphere of liquid.

Incidentally, *please* don't melt the Antarctic ice cap! That's supported on the Earth's crust, and the melting of it *would* raise the ocean level catastrophically.

GARRY J. TEE.

Flat 3, 7 Domain St.
Devonport,
Auckland 9,
New Zealand.

Dear Mr. Bova:

If Paul Nahin (October 1978 Brass Tacks) was referring to lawyers, he erred in claiming that they spend years learning "how to be obscure, illogical, and facile in the rapid production of mind numbing mumbo jumbo incantations. . . ."

I would tend to agree if his reference was to some members of Congress: after California voters approved Proposition 13, Big Spenders overnight converted to "long-time" economy advocates.

Law schools are considered among the better professional schools because they compel students to think logically and succinctly, and to advocate or oppose a position with logic and authority, not emotion. Law students learn that obscurity is self-defeating and that to be clear is to be effective.

Mr. Nahin appears to be unaware that a lawyer can offend "the other side" when the lawyer serves as an advocate, councilor, defender, expeditor or problem solver.

Uninformed denigration of lawyers can weaken the average person's ability to defend himself from an unfounded civil or criminal charge, or to protect his rights and privileges, or to be compensated for injuries.

HENRY KANE

Attorney at Law
Beaverton, Oregon 97005

Dear Mr. Schmidt:

Welcome to the editorship of Analog. Read of bad news on the horizon for Earthlings. The news is of the new UN Outer Space Committee's draft treaty which would establish a special international legal regime governing human activities on the Moon and we all know what that could mean. This article is in the November 78 issue of *Future* written by Michael A.G. Michaud. He further states that the treaty would make the Moon (and all other bodies in the solar system, except Earth) and its natural resources the common heritage of 'Mankind,' and would prevent any government organization or person from owning any part of the Moon's surface or subsurface, or any of the Moon's natural resources in place. It would also require that all space vehicles, equipment, facilities, stations and installations on the Moon (or any other body in the solar system) be open to inspection by other nations.

Well, what could all this mean? Possibly prevent industries or wealthy nations from supporting expanding their industrial base out into the solar system. We could call it a very pessimistic approach to the future of exploration. It's possibly the result of so much current environmentalism going

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on and the flexing of underdeveloped muscles. We could all look at the brighter side of preventing the expansion of warlike materials into space; leaving the contaminating humans on this planet and save the rest of the solar system; preventing us from expanding human beings out from this tiny island with the Dark Ages approaching again or maybe a tiny asteroid wiping us out or maybe a nuclear war.

Have they thought of their children's children's future?

CHESTER TWAROG
Galactic Citizen

Sir:

This letter is part criticism, part plea, and part solution to a problem that modern civilization seems to suffer from, perhaps to its ultimate demise. The pages of "Brass Tacks" serves as an arena wherein people of good intent and wide-ranging interests meet to exchange ideas. Who could ask for a better forum for the exposition of an idea?

It would be foolish to ignore the very real problems that we face today: war, famine, overpopulation, disease, pollution are just a few of the many and serious problems that could end civilization and man himself. Science fiction covers many of the "logical extensions" of trends, serving to educate and even warn of problems before they become too large to handle. Yet, the warnings often fall on deaf ears. We collectively continue on our ride to "hell in a basket". Why?

We have many problems that continue to be ignored simply because we, singly and collectively, refuse to accept responsibility for our individual and collective actions. Consider how we all want the benefits of industry, culture, and government. Yet, the negative effects are blamed on "technology/big business/big Government/society", never on individual or collective human actions. It is as if the workman who bends the nail and mashes his own thumb blames the hammer for his own lack of skill/attention to the job at hand. Man creates the political problems and conditions of war and the current political crises, yet the vague bogeyman "technology" is made the scapegoat for the great quantity of nuclear warheads in the world's arsenals. All is not darkness, however. The recent negotiations between Egypt and Israel give hope that some people are assuming responsibility for their own actions, thus removing a threat to life and limb. It may not prove to be the best possible solution, but it is at least an honest try.

So, we see that civilization, the scheme by which mankind cooperates in all activities larger than the immediate family (a good working definition), tends to blame the tools of civilisation (technology, religion, government, society, etc.) for the individual and collective mistakes, blunders, miscalculations and outright evils that have been, are being, and will be committed by mankind.

What solution or solutions can be applied to correct this situation? As an engineer I have attempted with varying success to assume responsibility for my own professional and personal actions. Recognizing my own lack of skill in convincing others I write this letter to Analog and the readers/writers of science fiction.

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Consider the story lines available in which a small community decided to assume near-complete responsibility/accountability for their own actions: Representatives elected to government would receive the active support and cooperation of the community, not the apathetic performance of a few voters once a year, with an occasional letter once in a while. What would be the social implications of a Congressional district where the staff of the representatives was boosted by volunteers to handle mail, conduct research, and all the other activities that are necessary for an intelligent process of government. Perhaps this would involve a modification of the New England "Town Hall" form of government.

Consider another example. A nuclear fission power plant is to be located in a remote site in order to avoid potential damage to the urban and suburban environments that it will supply power to, and who will pay for it? Instead of the multitude of licenses, permits, law suit, and other grief that has occurred in California in recent years, we see a cooperative effort among the various factions, devising a plan that all can live with. Place the nuclear station near a canal so that the cooling water is pumped to arid lands, excess heat in the water being used to heat local communities and to provide for fish farming. Out put of crops and fish protein would be planned to cover the loss of productive farmland occupied by the reactor site. A cordon of lightly-populated land is kept around the plant. Power lines and the associated right-of-way tracts are used to provide greenbelts through communities or to provide access roads. Intelligent planning would seem to be able to overcome the often petty complaining that would seem to be the current "ideal" of civil behavior in recent years. Anyone interested in writing such a story?

I will close by requesting that readers of Analog submit their own ideas on this subject. I want the negative as well as the positive comments. The wide range of interests and skills of those who are interested in science fiction will surely generate useful output that will leak over into the general public domain. A few seeds, carefully nurtured, can grow into a vast forest that supports a wide variety of life. Can we not do the same with our ideas, and stop blaming someone or something else for our problems?

GORDON J. DOUGLAS JR.

La Habra
CA

If the world has really been going to hell in a basket for as long as people have been saying that, it must have come a long, long way.

Anyway—yes, the sort of cooperative situation you describe sounds very appealing. But can you make it work? Small groups who set themselves up for that purpose can—but they tend to collapse eventually, when their heirs develop their own ideas about how things should be done. With a large group, you have the problems from the start. "A cordon of lightly-populated land" sounds fine—unless you're the guy who's asked to move out to make it that way.

Figuring out a harmonious scheme of life isn't the hard problem. The hard problem is getting real people to agree on one. SS

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Dear Stanley,

Congratulations on successfully seizing power at Analog. Long may you reign.

I have some comments on the December 78 issue. It is excellent. It also contains a (slightly camouflaged) debate. The guest editorial says SF is too optimistic; the state of the art feature asserts that SF is too gloomy. I disagree (not that both features weren't highly interesting). As it is not the purpose of SF to predict the future, one can write either gloomy or cheerful SF and still be writing good SF. Furthermore, there are so many unknowns and variables, that no one can be even faintly sure about the degree of cheer or gloom which will characterize the future. One could not predict the future even if one wanted to. SF shows us possible futures, and these are rightly of both the happy and unhappy varieties.

Also, let me complain about "In The Doghouse" by Orson Scott Card and Jay A. Parry. It is a good story, an enjoyable story . . . but flawed. An extratenestrial species which in their native form has no fingers or toes (pg 72, second column) nonetheless builds devices that enable mass mind transfer to Earth, to do bodies. Finding the result unsatisfactory, they still cannot build the machines for another transfer, because the dog bodies do not have fingers (page 85, 2nd column.) Don't you detect something illogical here? If fingers were unnecessary the first time, why are they necessary the second time? Actually the second time should be easier: dogs do, at least, have toes. Illogical; I protest!

DAVID PALTER

Hollywood, Cal. 90028

Dear Mr. Bova

Regarding Dean Ing's story, "Banzai" (September, 1978), I suppose Dean Ing realizes that a virus that encounters only one resistant individual in a population of 6×10^9 individuals is extremely improbable, for practical purposes impossible, but such a virus was needed for the story. But the inhabitants of Grissom face another danger that neither they, nor the author, seem to appreciate. Let me explain.

When the last ice age ended and the seas rose, Tasmania became cut off from the Australian mainland. So, therefore, were the Tasmanian aborigines, who at any one time numbered about 4,000 people. Their complete isolation lasted for 12,000 years.

Up to 3,800 years ago, fish contributed about 65% of their calorific intake from all flesh foods. Then fish dropped right out of their diet and never returned. In fact, Tasmanian aborigines recoiled with horror at the idea of human beings eating fish, when European explorers offered it to them. Their ancient camp sites contained bone tools, presumably used for making clothes, but the latest such tools are 3,000 years old, and the Tasmanian aborigines went naked year-round when Europeans first encountered them. They used fire, but had lost any knowledge of making it. The Tasmanian culture was in decline, presumably because of the smallness and isolation of the population.

On still smaller islands off Australia, where the populations were equally isolated but even smaller, the culture declined all the way. The aborigines of Kangaroo Island, 4,500 square kilometres south of South Australia,

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died out about 4,000 years ago.

The smallness and isolation of the population of Grissom will do it in for certain, especially as the ecology of a satellite requires such precise maintenance. The natives of Kangaroo Island didn't have to worry about maintaining their oxygen supply, after all. I've read various stories about generation ships and lost colonies in which the people had forgotten the finer points of Copernican astronomy, or of building ocean liners and cyclotrons. Offhand, though, I can't recall one in which the people lost even knowledge of immediate practical application, and which was applied daily. But it seems it can happen.

V. W. TERRILL

Victoria, Australia

Dear Mr. Schmidt:

I greatly enjoyed J.W. Schutz's discussion of "The Santa Claus Problem" in your January 1979 issue. However, I must take exception to some of his calculations. Certainly it would be more realistic to limit the visits of the Clausoid-being to child containing households that profess Christian Faith. Also, Mr. Schutz argues that the energetic requirements of the Clausoid-being's reindeer would necessitate the total stripping of the tundra of the Northern Hemisphere to fuel them on their journey. Perhaps the Clausoid-being has bred reindeer with highly efficient metabolisms. (Given that these creatures can supposedly fly, surely efficient metabolisms is little to ask.) But I quibble! Mr. Schutz's main thesis is sound. Surely the Clausoid-being *is* an extraterrestrial utilizing technology far more sophisticated than our own. Even more exciting, the same arguments apply to another familiar entity: THE EASTER BUNNY! (This and other revelations are discussed in my forthcoming book, *Earth: Tax Write-off of the Gods?*

G. V. HAROUTUNIAN, JR.

Dept. of Zoology
University of Montana

And we're expecting a dissertation on The Great Pumpkin any day now.

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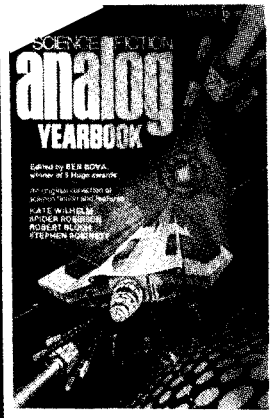

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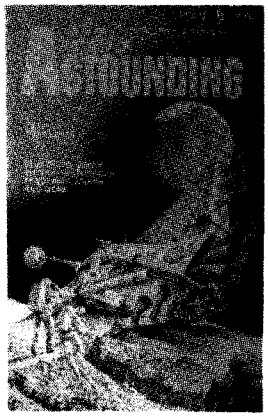

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